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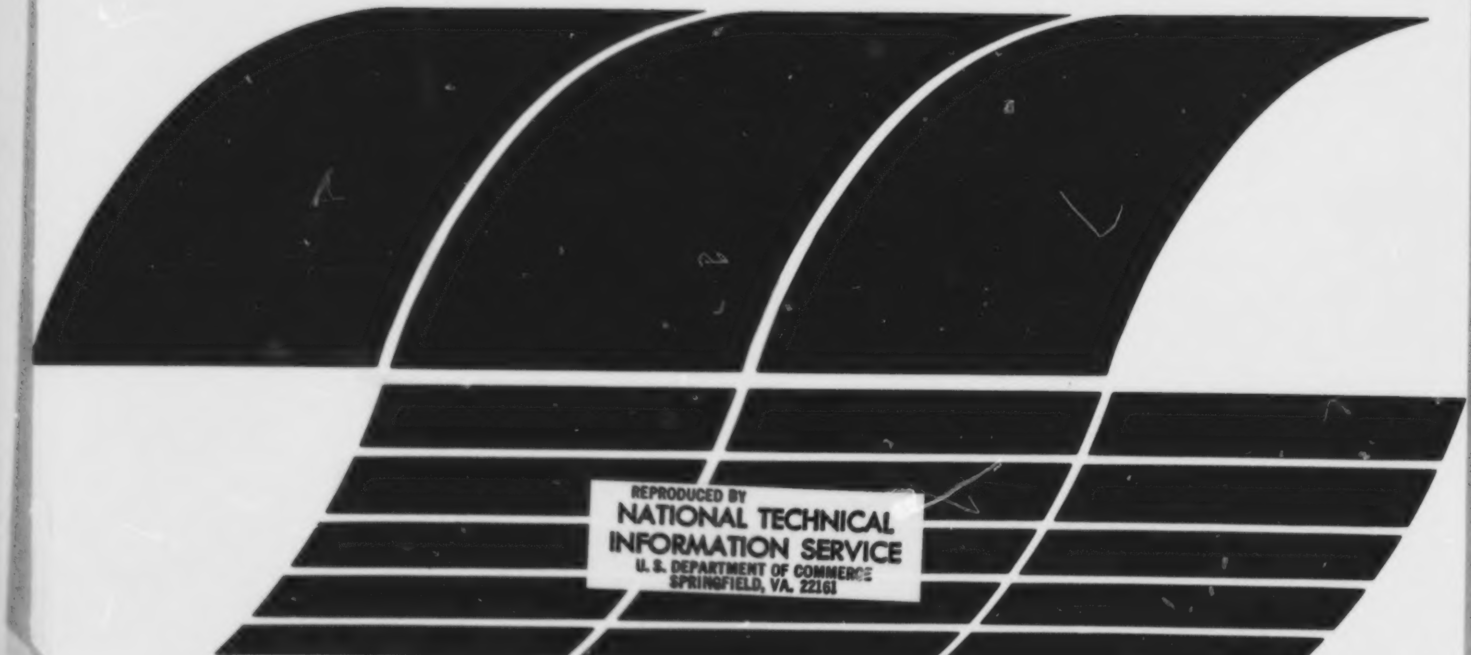
Interagency Energy/Environment R&D Program Report



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RESEARCH REPORTING SERIES

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1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy-Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the INTERAGENCY ENERGY-ENVIRONMENT RESEARCH AND DEVELOPMENT series. Reports in this series result from the effort funded under the 17-agency Federal Energy/Environment Research and Development Program. These studies relate to EPA's mission to protect the public health and welfare from adverse effects of pollutants associated with energy systems. The goal of the Program is to assure the rapid development of domestic energy supplies in an environmentally-compatible manner by providing the necessary environmental data and control technology. Investigations include analyses of the transport of energy-related pollutants and their health and ecological effects; assessments of, and development of, control technologies for energy systems; and integrated assessments of a wide range of energy-related environmental issues.

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OIL POLLUTION REPORTS (formerly OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly compilation of abstracts of current oil pollution-related literature, research projects, and conferences. Comprehensive coverage of terrestrial and aquatic oil pollution and its prevention and control is provided, with emphasis on the marine environment. The report contains (a) citations and summaries of 1975 to 1978 scientific and technical publications, and patents; (b) status and summaries of current research programs; and (c) information on current meetings. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01-0 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the U.S. Environmental Protection Agency.

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OIL POLLUTION REPORTS

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(February 1978 - May 1978)

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other materials relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci, to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL POLLUTION REPORTS (formerly entitled OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly compilation of abstracts of current oil pollution-related literature, research projects, and meetings. Comprehensive coverage of terrestrial and aquatic oil pollution and its prevention and control is provided, with emphasis on the marine environment. The report contains (a) citations and summaries of 1978 publications and patents; (b) status and summaries of current research programs; and (c) information on current oil pollution-related meetings. This report is submitted in partial fulfillment of EPA Grant No. R-805803-01-0 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the US Environmental Protection Agency.

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The authors wish to thank the personnel of the Marine Science Institute, the Science-Engineering Library, and Interlibrary Loans, of the University of California, Santa Barbara, for their assistance during the research stages of this project.

INTRODUCTION

OIL POLLUTION REPORTS (formerly OIL SPILL AND OIL POLLUTION REPORTS) is a quarterly bulletin which reviews pertinent scientific and technical publications, research projects, and meetings, to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, and other literature relating to oil pollution published since 1975 (Section I); summaries and status of current research projects (Section II); and current oil pollution-related conferences (Section III). This document series is now identified by volume and issue number; issues prior to 1978 were identified by quarterly dates alone, as shown on the following page.

Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. Items in Section I are categorized by eight major subdivisions which are divided into thirty-four specific subject categories. A list of the periodicals reviewed in preparing this series appears in Appendix A.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications provided upon request by the principal investigators or performing organization. Notices of research projects are obtained primarily from the Smithsonian Science Information Exchange (SSIE). Entries are arranged according to the same subject categories as in Section I. Some of the projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted with a current serial number, followed by the original number in parentheses.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following: C, reports, publications, and patents; and R, research projects. Subject, author, and patent indexes are provided at the end of the report.

Section III, Current Conferences, contains descriptive information on recently held and upcoming meetings relevant to any aspect of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of oil pollution-related papers are included. All information for this section was obtained from the periodicals reviewed (Appendix A) and from responses to written inquiries concerning the meetings.

OIL POLLUTION REPORTS
(Oil Spill and Oil Pollution Reports, 1974 to Vol. 5 No. 1)

Issues currently available, in press, or in preparation

	Dates Covered	Report Number
1974	July 74 - Oct. 74	EPA-670/2-75-003
1975	Nov. 74 - Feb. 75	EPA-670/2-75-044
	Feb. 75 - Apr. 75	EPA-670/2-75-059
	May 75 - July 75	EPA-600/2-76-129
	Aug. 75 - Oct. 75	EPA-600/2-76-113
1976	Nov. 75 - Jan. 76	EPA-600/2-76-185
	Feb. 76 - Apr. 76	EPA-600/2-76-215
	May 76 - July 76	EPA-600/2-76-266
	Aug. 76 - Oct. 76	EPA-600/2-77-037
1977	Nov. 76 - Jan. 77	EPA-600/2-77-075
	Feb. 77 - Apr. 77	EPA-600/2-77-111
	May 77 - July 77	EPA-600/2-77-243
	Aug. 77 - Oct. 77	EPA-600/2-78-005
Vol. 5 No. 1	Nov. 77 - Jan. 78	Submitted 2/78
Vol. 5 No. 2	Feb. 78 - May 78	Submitted 6/78
Vol. 5 No. 3	June 78 - Sep. 78	In preparation
Vol. 5 No. 4	Oct. 78 - Dec. 78	To be prepared

For complete ordering information, please see Appendix B.

ABBREVIATIONS

atm	atmosphere
bbl	barrel
°C	degrees Centigrade
cm	centimeter
dwt	dead weight ton
EIS	environmental impact statement
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GC	gas chromatography
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
in	inch
IR	infrared
kg	kilogram
km	kilometers
kn	knot
L	liter
lb	pound
LC	liquid chromatography
LD	lethal dose
LNG	liquified natural gas
LOT	load on top
LPG	liquified petroleum gas
m	meter
mg	milligram
mi	miles
min	minute
ml	milliliter
mm	millimeter
MS	mass spectrometry
OCS	outer continental shelf
oz	ounce
PAH	polycyclic aromatic hydrocarbons
pH	the negative log of the H ion concentration
ppb	part per billion
ppm	part per million
sp.	species
TLC	thin-layer chromatography
US	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
WSF	water soluble fractions
wt	weight
yr	year
μ	micron
μg	microgram
%	percent
/	per

ACRONYMS

API	American Petroleum Institute
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FAO	Food and Agriculture Organization
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USCG	United States Coast Guard (DOT)
USGS	United States Geological Survey
USDI	United States Department of Interior
USDA	United States Department of Agriculture
USN	United States Navy

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-0312-78
EKOFISK: INADEQUATE PROTECTION, BUT GOOD FORTUNE KEPT DAMAGE TO A MINIMUM (news brief)
Anon. 1977.
Offshore England No. 6:24-25.

Ekofisk blowout, Environmental effects, Fate, Evaporation, Pollution control

It is generally recognized that a large amount of good fortune minimized the consequences of the Ekofisk blowout. There were no fires, no injuries, and little damage to the platform; the spill occurred between the spawning period for cod and mackerel, and prevailing winds kept the slick near its source until much of it evaporated. It is also conceded that available antipollution measures and firefighting equipment were inadequate.

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13393. 1977]

C-0313-78
HONG KONG OIL SPILL (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(12):267.

Oil spills, Fuel oil, Fish, Mortality, Spill cleanup, *Adrian Maersk, *Hong Kong

More than 20,000 kg of mature fish and an estimated 400,000 individual fry, fingerlings, and immature fish were killed by oil spilled from a Danish freighter. The Adrian Maersk ran aground off Lamma Island, Hong Kong, spilling 400 tons of bunker oil. Spray chemicals and booms were used to clean up the slick, but nearly 120 fish farms had combined losses of more than £1 million.

C-0314-78
WEST AFRICAN COASTAL POLLUTION (news brief)
Anon. 1977.
Waste Water Treatment 20(3):40.

Contamination, Coasts, Pollution control, Africa

"The marine pollution problems in West African countries bordering the Gulf of Guinea were surveyed for nine weeks. Several recommendations are given for the control or reduction of pollution in these countries in consultation with the governments concerned. Two main types of pollution were encountered: oil pollution and pollution from sewage and industrial waste."

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13543. 1977]

C-0315-78
PRELIMINARY STUDY ON THE MARINE POLLUTION IN ECUADOR. SUMMARY [in Spanish]
Aguiar, F. H. 1976.
Rev. Com. Perm. Pac. Sur. No. 5:161-163.

Hydrocarbons, Detection, Pollution control, Ecuador

The presence of pollutants, including hydrocarbons, off the coast of Ecuador is briefly reviewed. The activities of the National Oceanographic Institute and legal approaches to marine pollution control in Ecuadorean waters are described.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11779. 1977]

C-0316-78
CHANGES AND CHALLENGES IN OCEAN DATA AND INFORMATION SERVICES
Austin, T. S. 1978.
Sea Technology 19(2):12.

Information systems, Statistics, Guidelines, Models, Environmental effects, NOAA

Established in 1965, NOAA's Environmental Data Service (EDS) provides multi-disciplinary data, and information analysis and assessment, which aid in solving environmentally-related problems. EDS scientists have participated in onsite studies including analyzing and documenting the Argo Merchant spill, and assessing ecological consequences of oil and gas exploration, development, and production on Alaska's outer continental shelf. EDS scientists also have developed a statistical oil spill trajectory risk model.

C-0317-78
CANADIAN ENVIRONMENTAL EMERGENCIES EVENT SUMMARIES FOR 1974, 1975, AND 1976
Beach, R. A., and K. M. Meikle. 1978.
Spill Technology Newsletter 3(1):19-23.

Oil spills, Statistics, Information systems, Canada, *NATES

Oil and other hazardous materials spills data for Canada are presented for the years 1974, 1975, and 1976, based on information available from NATES, the National Analysis of Trends in Emergencies System. Of the 3,445 spills reported during this time period, human error and equipment failure accounted for over 40%.

C-0318-78
MAJOR OIL SPILL DIRECTORY
Center for Short-Lived Phenomena. 1975.
New York, Unipub, 1975. 142p.

Oil spills, Statistics, Environmental effects, Spill cleanup, *Computer directory

This directory presents a systematic listing - on computer printout - of all the major oil spills that occurred on the world's oceans from 1967 through 1975. Spill characteristics include resources affected, cause, and impact; clean-up characteristics include costs, payors, and techniques.

[from Maritime Research Information Service Abstracts Vol. 15: #14 147570. 1977]

C-0319-78
INVESTIGATION OF OIL POLLUTION ON THE POLISH BALTIC COAST IN 1974/1975 [English summary]
Gorski, W., B. Jakuczun, C. Nitecki, and A. Petryna. 1976.
Przeglad Zoologiczny 21(1):20-23.

Sampling, Statistics, Birds, Coasts, Baltic Sea, Poland

"The material contained 667 dead water birds from 20 species. The most numerous species were: Clangula hyemalis (46.8%), Melanitta fusca (15.2%), Melanitta nigra (10.4%), Larus argentatus (5.6%), Podiceps cristatus (5.1%) and Larus ridibundus (5.1%). . . . The highest number of dead birds was found in March and April (42.3%). Many birds (82%) had oiled plumage."

[from Biological Abstracts 65(2):#12197. 1977]

C-0320-78
SCOTT INLET SLICK: AN ARCTIC OIL SEEP?
Levy, E. M. 1977.
Spill Technology Newsletter 2(6):21-27.

Oil slicks, Natural seepage, Sampling, Canada, *Baffin Island

On several occasions during 1976-1977 research cruises, extensive oil slicks were observed at 71°24'N, 70°10'W, near Scott Inlet, Baffin Island. This article is a brief report of visual observations and attempts to sample the slick in September, 1977. The results were inconclusive and further research is planned.

C-0321-78
THE EKOFISK BRAVO BLOWOUT
Vanderkooy, N. 1977.
Spill Technology Newsletter 2(3):15-25.

Ekofisk blowout, Spill cleanup, Environmental effects, Crude oil, North Sea, Norway

A synopsis is presented of the Ekofisk Bravo blowout event which occurred in the North Sea off Norway in April 1977. The extent of the blowout and subsequent cleanup measures are described and illustrated with on-scene photographs. A total of nearly 20,000 tons of crude oil was spilled, most of which evaporated or dispersed into the water column before cleanup was undertaken. Environmental effects appeared to be minimal. The role of the Norwegian spill response structure which was mobilized for this event is briefly outlined.

2. MONITORING

C-0322-78
OIL CONTENT ANALYSER
Anon. 1977.
Marine Engineering Review, April:42.

Monitoring, Ballast, Bilges, Ships, Design-engineering, Detection, Product information, *Oil content analyser

The Finnish industrial company SLO has developed the Oili Analyser, a continuous-operation measuring device for determining the oil content of shipboard ballast and bilge waters. The device is accurate to ±10 ppm and automatically sets off alarms when the oil content reaches predetermined limits.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11795. 1977]

C-0323-78
OIL MONITORING DEVELOPMENT (product information)
[Babcock Controls]. 1978.
Marine Pollution Bulletin 9(2):33.

Monitoring, Product information, Ballast, Pollution control, Equipment, *Babcock Controls

A de-ballasting monitor is being marketed by Babcock Controls. The instrument gives a digital readout of the amount of oil discharged per mile in contrast to other products which provide only the oil-in-water content. The new device gives an early warning for shutdown of the discharge system if the set limit is exceeded.

C-0324-78
WORLDWIDE DIRECTORY OF POLLUTION MONITORING PROGRAMS
Center for Short-Lived Phenomena. 1975.
New York, Unipub, 1975. 2000p.

Monitoring, Information systems, Statistics, *Computer directory

This four-volume set contains a major computerized data base on more than 700 programs operating over 60,000 pollution monitoring sites in 78 countries and all oceans. Directory, operational, and technical information is presented for each program. The document was prepared by the Smithsonian Institution for the United Nations Environment Program (UNEP).

[from Maritime Research Information Service Abstracts Vol. 15: #14 147568. 1977]

C-0325-78
PETROLEUM CONTENT OF WATER AROUND THE FINNISH COAST [in Swedish]
Erkomaa, K. 1976.
NORDFORSK, Miljoevardssekretariatet Publikation. p. 271-278.

Monitoring, Hydrocarbons, Coasts, Seawater, Sampling, Finland

"The content of nonpolar hydrocarbons in Finnish coastal waters was <0.10 mg/L in 1971 and <0.05 mg/L in 1972. The difference was caused by different weather conditions and sampling methods. Comparison with Swedish and Russion investigations indicate a lower oil content in Finnish seawater."

[from Chemical Abstracts 87(12):#90477j. 1977]

C-0326-78
POLLUTANTS IN THE AQUATIC ENVIRONMENT: DETECTION, MEASUREMENT, AND MONITORING
Food and Agriculture Organization. 1976.
Rome, Food and Agriculture Organization, 1976. 109p.

Monitoring, Detection, Chemical analysis, Pollution control, Dispersants, Toxicity, *Bioassay

The document provides a broad review of pollutants and pollution control procedures. Chapters discuss chemical analyses of water; oil and oil dispersants; toxicity testing; redox measurements in natural waters and sediments; and bioassay methods.

C-0327-78

METHOD AND A DEVICE FOR DETECTING CONTAMINANTS IN PROCESS WATER

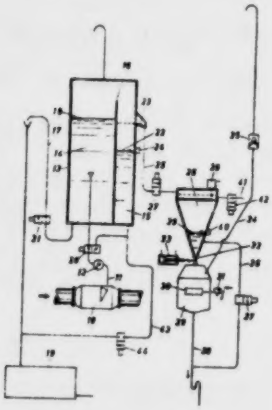
Hakansson, E. 1977.
US Patent 3,908,443

Monitoring, Detection, Sampling, Petroleum products, Wastewaters, Patent

"A sampling device for detecting oil and gasoline in water."

[from Environmental Technology and Economics No. 17:7. 1977]

3,908,443
METHOD AND A DEVICE FOR DETECTING CONTAMINANTS IN PROCESS WATER
Erik Hakansson, Landskrona, Sweden, assignor to Gotaverkin Oresundsvarvet AB, Landskrona, Sweden
Filed Mar. 6, 1974, Ser. No. 448,747
Claims priority, application Sweden, Mar. 7, 1973, 7303163-5
Int. Cl.^{2} G01N *33/18*
U.S. Cl. 73—61.1 R **6 Claims**



C-0328-78

APPARATUS FOR INDICATING INSOLUBLE LIQUID LAYERS ON CONDUCTING LIQUIDS

Heidenreich, R. 1977.
German Offenlegungsschriften (unexamined patent application) 2,601,410

Monitoring, Detection, Petroleum products, Pollution prevention, Patent

The device described is designed to sound an alarm in the presence of a nonconducting layer, e.g., oil or fuel, on water. Two electrodes are covered with a substance which is insoluble in water and soluble in oil or fuel. When the compound dissolves in the presence of oil or fuel, the electrical circuit is closed and an alarm sounds.

[from Chemical Abstracts 87(22):#169701m. 1977]

C-0329-78
APPARATUS FOR MEASURING THE OIL CONTENT IN OIL-IN-WATER MIXTURES
Hogh, M. S. 1977.
German Offenlegungsschriften (unexamined patent application)
2,642,917

Monitoring, Detection, Emulsions, *Oil in water, Patent, *Photosensor

The oil content of oil-water mixtures are determined by using a light source, glass fiber optic light conductors, and a photoelectric cell for measuring the intensity of light transmitted through the liquid mixture.

[from Chemical Abstracts 87(10):#70758y. 1977]

C-0330-78
THE ICES COORDINATED MONITORING PROGRAMME IN THE NORTH SEA, 1974
International Council for the Exploration of the Sea. 1977.
ICES, Cooperative Research Report No. 58. 19p.

Monitoring, North Sea, Contamination, *International program

Summary not available.

[from Underwater Information Bulletin 9(4):#7708/1329. 1977]

C-0331-78
WESTERN COAL AND OIL SHALE - GROUNDWATER QUALITY MONITORING RESEARCH AND DEVELOPMENT
McMillion, L. G. 1977.
Energy/Environment II - National Conference on the Interagency Research & Development Program, 2nd, Washington, D.C., 1977.
p. 411-414. Report EPA-600/9-77-012. (EPA Decision Series)

Monitoring, Oil shale, Development, Groundwater, Water quality, Environmental effects, *Surface mining

The mining of oil shale and coal in the western United States will result in widespread effects on topography, drainage patterns, recharge areas, groundwater flow patterns and groundwater quality. In addition, accidental releases of low quality mine waters due to evaporation pond failure, ground subsidence, and spillage are likely to impact the environment. In this paper, groundwater monitoring methodology as it applies to oil shale and coal development is summarized, and research needs are identified.

C-0332-78
THE MEASUREMENT OF OIL SPILL VOLUME BY A PASSIVE MICROWAVE IMAGER
Troy, B. E., Jr., and J. P. Hollinger. 1977.
Report NRL - MR - 3515. 66p.

Monitoring, Detection, Oil slicks, *Passive microwave imager

A test program to detect a marine oil spill and to determine its thickness and volume has developed an airborne passive microwave system. The color microwave images outlined the entire visible slick and located the thick oil regions which had a maximum thickness of 0.6 mm. Volume was determined by integration of the oil thickness over area.

[from Government Reports Announcements 77(20):#AD-A041 821/OGA. 1977]

C-0333-78
DEVELOPMENT OF A SHIPBOARD POLLUTION MONITORING SYSTEM
Tyler, B., W. Gongaware, and T. Houlihan. 1977.
Analysis Instrumentation No. 15:103-107.

Monitoring, Ships, Bilges, Design-engineering, Detection, *Carbon analysis

An automatic monitoring system pumps shipboard water through a sampling mechanism. Samples are oxidized and analyzed for total C in a Beckman Model 915 Total Organic Carbon Analyzer. Continuous monitoring of oil-water pollution is thus performed.

[from Chemical Abstracts 87(20):#156553q. 1977]

C-0334-78
DETERMINATION OF FREE OIL IN OIL-CONTAINING SLUDGES
Uematsu, K., and T. Morimura. 1977.
Japanese Kokai (unexamined patent application) 77 46,893

Monitoring, Fuel oil, Detection, Sludge, Patent, *UV fluorescence

A specified volume of oil-containing sludge is added to water to separate the oil, and the floating oil is irradiated with UV, 320-400 nm. The fluorescent ray is passed through a 380-460 nm filter and detected by a phototube. By this method, a few ppm of fuel oil in sludge can be detected.

[from Chemical Abstracts 87(12):#90432r. 1977]

C-0335-78
NEW PRODUCTS (product information)
[Wright & Wright, Inc.]. 1978.
Spill Technology Newsletter 3(1):7.

Monitoring, Detection, Product information, Equipment, *Infrared detectors

Wright & Wright, Inc. manufactures a series of infrared detectors that are mounted over streams, holding ponds, drains, sewers, tanker berths, etc., to provide early warning of oil spillage. More information is available from Wright & Wright, Inc., P.O. Box A, Oak Bluffs, MA 02557.

3. REMOTE SENSING

C-0336-78
LANDSAT USES SPACE PROGRAM KNOWLEDGE TO SOLVE ENVIRONMENTAL RESOURCE PROBLEMS
Anon. 1977.
Environment Reporter 8(2):65-66.

Remote sensing, EPA, Monitoring, Oil spills, *Landsat, *Enviro-Pod

Although many environmental pollution-related problems can be monitored and analyzed using Landsat satellite remote sensing techniques, Landsat is not an effective tool for responding to environmental episodes such as oil spills, where rapid response, fine target resolution, and insensitivity to adverse weather are needed. Environmental disasters, such as oil spills, are better monitored using an "Enviro-Pod", a compact, low-cost, and quick-response aerial unit that can be transported to the scene and mounted on available small aircraft. An "Enviro-Pod" system is currently under evaluation by EPA.

C-0337-78
SPOTTING OIL SLICKS BY SATELLITE (news brief)
Anon. 1977.
New Scientist 75(1061):163.

Remote sensing, Oil slicks, Blowouts, Monitoring, *NASA Heat Capacity Mapping Mission

The potential use of satellites for monitoring offshore oil producing areas for Ekofisk-type blowouts and tanker spills will be investigated by NASA. An experimental satellite will be launched as part of the NASA Heat Capacity Mapping Mission which will study the various heat-absorbing and reflecting properties of land and water bodies.

[from Aquatic Science & Fisheries Abstracts 7(10):#7Q13534. 1977]

C-0338-78
REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT (A BIBLIOGRAPHY WITH ABSTRACTS)
Hundemann, A. S. 1977.
Report NTIS/PS-77/0674. 138p. Report for 1964 - July 1977.

Remote sensing, Detection, Dispersions, Monitoring, Estuaries

This updated bibliography contains 133 abstracts, all of which are new to the previous report. Topics covered include characteristics of dispersion and diffusion by which pollutants are transported, monitoring of oil spills, and application of remote sensing to estuarine problems.

[from Government Reports Announcements 77(20):#NTIS/PS-77/0674/OGA. 1977]

C-0339-78
A METHOD FOR REMOTE DETECTION OF OIL SPILLS USING LASER-EXCITED RAMAN BACKSCATTERING AND BACKSCATTERED FLUORESCENCE
Sato, T., Y. Suzuki, H. Kashiwagi, M. Nanjo, and Y. Kakui. 1978.
IEEE Journal of Oceanic Engineering OE-3(1):1-4.

Remote sensing, Oil spills, Analytical techniques, Detection, *Backscattering techniques

A laser method for remote sensing of marine oil spills using the title methods is discussed. "The scattering spectra of oils obtained by using a laser Raman spectrometer that employs a CW Ar laser are described. The backscattering spectra of oils obtained by a laser radar technique in the laboratory and the field are also described. Furthermore, theoretical performance of a laser radar with a CW laser or a pulsed laser for the detection of Raman backscattering of kerosene is discussed."

4. SAMPLING

C-0340-78
DISTRIBUTION OF PETROLEUM LUMPS INHABITED BY NEUSTONIC PERIPHYTON IN THE SURFACE LAYER OF THE ATLANTIC, SOUTHERN AND INDIAN OCEANS [English summary]
Benzhitskij, A. G., and G. G. Polikarpov. 1977.
Biologiya Morya No. 2:88-91.

Sampling, Tar, Oceans, Neuston, Distribution, Atlantic Ocean, Indian Ocean, *Neustonic periphyton

The title study was conducted during a research cruise lasting from December 1974 to May 1975. Petroleum lumps were nearly ubiquitous in the 0-25 cm layer of the area surveyed; these were inhabited primarily by peculiar neustonic periphyton consisting of attached organisms, and also some neustonic hydrobionts using the lumps for attaching their reproductive products. The composition of the neustonic periphyton varied with the degree of substrate mineralization, geographical location and local biological and oceanographic conditions.

[from Aquatic Sciences & Fisheries Abstracts 7(12):#7Q16493. 1977]

C-0341-78

A FIVE-YEAR STUDY OF THE OCCURRENCE OF NON-POLAR HYDROCARBONS (OIL) IN BALTIC WATERS 1970-1975

Carlberg, S. R. 1977.

Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171.

Petroleum Hydrocarbons in The Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Sampling, Hydrocarbons, Chemical analysis, Baltic Sea

Water samples were collected from several depths in the Baltic and Kattegat areas from 1970-1975 and analyzed for non-polar hydrocarbons by an infra-red technique. The percentage of samples containing <0.05 mg/L (the detection limit) was 84 in the Baltic and 74.4 in the Kattegat area. Results were critically evaluated.

C-0342-78

PLASTICS, PELAGIC TAR, AND OTHER LITTER

Carpenter, E. J. 1976.

Strategies for Marine Pollution Monitoring. E. D. Goldberg (ed.). Wiley Interscience, 1976. p. 77-92.

Sampling, Tar, Oceans, Chemical analysis, Equipment, *Plastics, *Litter

Equipment and methods for sampling plastics, pelagic tar and other litter on the sea surface are surveyed. Neuston nets of various designs are featured as the most widely applicable tools for sampling. Several analytical techniques are available for identifying the floating contaminants.

C-0343-78
SAMPLING AND CLEANUP OF AROMATIC POLYCYCLIC HYDROCARBONS
Chovin, P. 1976.
Environmental Pollution and Carcinogenic Risks. C. Rosenfield and W. Davis (eds.). Paris, Institut National de la Santé et de la Recherche Médicale, 1976. Proceedings of an International Symposium, Lyon, France, 3-5 November, 1975. p. 355-368.

Sampling, Contamination, Carcinogens, PAH, *Contaminant removal

Summary not available.

[from Current Contents: Life Sciences 19(48):25. 1976]

C-0344-78
COMPOSITION AND WEIGHT PER AREA OF PELAGIC TAR COLLECTED BETWEEN PORTUGAL AND SOUTH OF THE CANARY ISLANDS
Ehrhardt, M., and J. Derenbach. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:69.
Petroleum Hydrocarbons in The Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.). Abstract.

Sampling, Tar, Chromatography, Distribution, Atlantic Ocean, *Composition, *Weight

A neuston sampler was used to collect 22 samples of pelagic tar in January/February 1975. Dimensions ranged from "potato-size" to 1 mm diameter, and concentrations varied between 20.5 and 0.007 mg/m^2. Composition of the tar balls was independent of their size, suggesting diffusion-controlled degradation.

C-0345-78
OCCURRENCE OF HYDROCARBONS IN THE SURFACE FILM, SUB-SURFACE WATER AND SEDIMENT IN THE WATERS AROUND THE UNITED KINGDOM
Hardy, R., P.R. Mackie, K.J. Whittle, A.D. McIntyre, and R. A. A. Blackman. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:61-65.
Petroleum Hydrocarbons in The Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Sampling, Hydrocarbons, Sea surface, Seawater, Distribution, Sediments, Chromatography, *n-alkanes

The amounts of n-alkanes (C_{15}-C_{33}) were measured by gas chromatography in the title areas selected on the basis of expected petroleum input. Similar distributions of n-alkanes were found in surface film and sub-surface water samples, but these were significantly different from the distribution in the sediment. It was undetermined whether the n-alkanes were petroleum derived or not.

C-0346-78
GAS-LIQUID CHROMATOGRAPHY ANALYSIS OF HYDROCARBONS IN MARINE SEDIMENTS AND WATERS
Hung, T.-C., Y.-L. Lee, and L. Hsyng. 1977.
Bulletin of the Institute of Chemistry, Academia Sinica Vol. 24: 31-41.

Sampling, Natural seepage, Hydrocarbons, Detection, Coasts, *Taiwan

Studies were made of surface waters along the west coast of Taiwan in order to detect possible seeps from natural gas and petroleum deposits. Hydrocarbons in the water were extracted with chloroform and analyzed by gas-liquid chromatography.

[from Chemical Abstracts 87(12):#90519z. 1977]

C-0347-78
HYDROCARBONS IN BIOLOGICAL MATERIAL AND SEDIMENTS FROM GREENLAND'S COASTAL WATER [in Danish]
Jensen, V. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 255-269.

Sampling, Hydrocarbons, Fish, Invertebrates, Sediments, Coasts, Greenland

Hydrocarbons were detected in fish, invertebrates, and sediments in oil concession areas off West Greenland. The concentrations of pentane extractable lipids are presented.

[from Chemical Abstracts 87(12):#90476h. 1977]

C-0348-78
SAMPLING AND EXTRACTION METHODS AND THEIR ASSOCIATED PROBLEMS
Mackie, P.R., R. Hardy, and K. J. Whittle. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:27-32.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Sampling, Extraction, Contamination, Seawater, *n-alkane analyses

The application of n-alkane analyses to the problems of obtaining representative samples and of minimizing sample contamination is discussed.

C-0349-78
HYDROCARBONS IN THE OCEANS
Myers, E. P., and C. G. Gunnerson. 1976.
Boulder, Colorado, NOAA Environmental Research Laboratories, & Maritime Administration, 1976. 42p. Marine Ecosystems Analysis Program (MESA) Special Report.

Sampling, Hydrocarbons, Oceans, Baseline studies, Sea surface, *Coastal waters, *Shipping lanes

Measurements of hydrocarbons from ocean waters throughout the world are presented to provide baseline information for ongoing and planned pollution studies. The data indicate an average of 1-10 ppb total hydrocarbons for most surface and near surface waters. Both biogenic and petroleum hydrocarbons appear to be ubiquitous, but petroleum hydrocarbons appear to be somewhat concentrated in coastal waters and shipping lanes.

C-0350-78
NATURAL VARIABILITY IN DISTRIBUTION OF AN INTERTIDAL POPULATION OF MACOMA BALTHICA SUBJECT TO POTENTIAL OIL POLLUTION AT PORT VALDEZ, ALASKA
Myren, R. T., and J. J. Pella. 1977.
Marine Biology 41(4):371-382.

Sampling, Distribution, Mollusks, Baseline studies, Alaska, Ports, Intertidal zone, *Macoma balthica

Natural variability in the abundance of the title mollusk was measured over a 2-year period to provide baseline data for the proposed Port Valdez oil terminal. Sampling was conducted at 7 different times and at various elevation contours. This report documents the changes, or persistent differences, in the organism's population densities at various elevations and sampling times.

[from Biological Abstracts 64(10):#55676. 1977]

C-0351-78
STUDY OF ORGANIC COMPOUNDS OF OIL FIELD WASTE WATERS [in Russian]
Sharifov, R. R., Sh. I. Ismailov, and T. L. Gusein-Zade. 1976.
Azerbaidzhanskii Khimicheskii Zhurnal No. 4:131-133.

Sampling, Wastewaters, Oil fields, Hydrocarbons, *Organic compounds

An organic product extracted from oil field wastewaters is described. The substance consisted of a complex mixture of high molecular weight naphthenic-paraffinic and unsaturated compounds.

[from Chemical Abstracts 87(12):#90183k. 1977]

C-0352-78
A COMPARISON OF HYDROCARBONS IN ANIMALS AND THEIR BENTHIC HABITATS
Teal, J. M., and J. W. Farrington. 1977.
Rapports et Proces-Verbaux des Reunions. International Council for the Exploration of the Sea. Vol. 171:79-83.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Sampling, Hydrocarbons, Benthos, Sediments, Marine organisms, Uptake, Fate

Benthic animal and sediment samples were taken from uncontaminated coastal sediments, chronic hydrocarbon input sediment, and an oil spill salt marsh area. Significant differences exist between the composition of hydrocarbons in the animals and their habitat. Uptake, metabolism, and degradation are discussed.

C-0353-78

THE ALKANES OF MARINE ORGANISMS FROM THE UNITED KINGDOM AND SURROUNDING WATERS

Whittle, K. J., P. R. Mackie, R. Hardy, A. D. McIntyre, and R. A. A. Blackman. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:72-78.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Sampling, Hydrocarbons, Plankton, Invertebrates, Fish, Chromatography, UK, *n-alkanes

"Mixed plankton samples and various tissues from 11 species of invertebrates and 19 species of fish, representing some 255 samples in total, have been analysed for alkanes by capillary gas-liquid chromatography. On a comparative weight-basis, the plankton samples had the highest n-alkane values, particularly at the coastal sites adjacent to industrial urban areas. The remaining animal samples fell within a range of means from 0.1 to 20 μg/g wet weight, the higher value usually found in fatty tissues." The origin of n-alkanes was undetermined.

C-0354-78

HYDROCARBON CONTENT AND CHLOROPHYLL CORRELATION IN THE WATERS BETWEEN NOVA SCOTIA AND THE GULF STREAM

Zsolnay, A. 1977.
Deep-Sea Research 24(2):199-207.

Sampling, Hydrocarbons, Atlantic Ocean, *Nova Scotia, *Gulf Stream, *Biogenic hydrocarbons

The average hydrocarbon content found in 23 water samples from the euphotic zone was about 4.9 μg/L. Based on a model relating hydrocarbon and chlorophyll concentrations, the hydrocarbons were concluded to be of biogenic origin.

[from Chemical Abstracts 87(10):#73129e. 1977]

5. ANALYSIS

C-0355-78
STANDARDIZATION OF GAS CHROMATOGRAPHIC HYDROCARBON ANALYSIS
Adlard, E. R. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:39-40.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Chromatography, Hydrocarbons, *Standardization methods

A brief statement stresses the need to use standard methods and to include complete analytical information in marine biology research papers. A correlation trial on 4 oils for determination of *n*-alkane/isoprenoid hydrocarbon peak height ratios carried out by 6 laboratories differed for one oil by more than a factor of ten.

C-0356-78
CRITICAL STUDY OF THE ANALYTICAL METHODS USED FOR THE DETERMINATION OF POLLUTION IN MARINE ENVIRONMENT. 3. ORGANIC MICROPOLLUTANTS [in French]
Alzieu, C., and P. Michel. 1976.
Revue des Travaux de l'Institut des Peches Maritimes 40(1): 71-106.

Chemical analysis, Analytical techniques, Surfactants, Hydrocarbons, Detection, Seawater

"The authors describe the analytical methods used for the determination of organic micropollutants in sea water, such as chlorinated pesticides, for the determination of anionic surface active material and for establishing levels of petroleum hydrocarbons in the marine environment."

[from Aquatic Sciences & Fisheries Abstracts 7(11):#7Q14877. 1977]

C-0357-78
TRACING THE OIL COMPONENTS OF MARINE ORGANISMS [in Danish]
Boeler, J. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 279-288.

Chemical analysis, Marine organisms, Hydrocarbons

"The lipid phase in *Patella aspera* contained n-C_{17} 28.0, n-C_{15} 12.1, pristane 6.0, and other neutral hydrocarbons in concentrations of ∿1 ppm. *Patella vulgata* and *Nucella lapillus* contained considerable amounts of C_{23}-C_{29} hydrocarbons. Pristane occurred in high concentrations in the lipids of *Nucella* (194.3 ppm) and *Dosina exoleta* (86.5 ppm)."

[from Chemical Abstracts 87(11):#81500j. 1977]

C-0358-78

IDENTIFICATION OF OIL COMPONENTS BY GAS CHROMATOGRAPHY FOLLOWED BY LOW TEMPERATURE LUMINESCENCE ANALYSIS
Brownrigg, J. T., and A. W. Hornig. 1976.
Pittsburg, Pennsylvania, Conference on Analytical Chemistry & Applied Spectroscopy No. 406, 1976.

Chemical analysis, Chromatography, Source identification, *Luminescence analysis

Gas chromatography was followed by low temperature (77°K) luminescence analysis in a study to identify major emitting components of oil. Data was used to interpret the luminescence of non-chromatographed samples, which led to a better basis for the phenomenological methods of oil identification now in use.

[from Maritime Research Information Service Abstracts Vol. 15: #14 149591. 1977]

C-0359-78

PETROLEUM: PROPERTIES AND ANALYSES IN BIOTIC AND ABIOTIC SYSTEMS
Clark, R. C., Jr.,and D. W. Brown. 1977.
Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms. Vol. I, Nature and Fate of Petroleum. D. C. Malins (ed.). New York, Academic Press, Inc., 1977. p. 1-89.

Chemical analysis, Crude oil, Petroleum products, Hydrocarbons, Marine organisms, *Biogenic hydrocarbons

Chemical and physical properties of petroleum and petroleum products are summarized, and methods of preserving, extracting, separating and analyzing petroleum products in environmental samples are discussed. A brief section on hydrocarbons and non-hydrocarbons in petroleum and organisms is included, and a list of basic differences between hydrocarbons from abiotic and biotic systems is provided. A list of 181 references is included at the end of this chapter (Chapter 1).

C-0360-78

AROMATIC HYDROCARBON ANALYSIS BY GAS-LIQUID CHROMATOGRAPHY
Doran, T. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:49-52.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Chemical analysis, Aromatic hydrocarbons, Chromatography, PAH

The general approach to the analysis of aromatic hydrocarbons in petroleum fractions is outlined, and the problems associated with factors such as increasing carbon number are addressed. It is suggested that several techniques are necessary for such complex analysis rather than resolution by gas chromatography alone. An experiment simulating the solvent extraction effect of seawater on crude oil is briefly described.

C-0361-78
MARINE HYDROCARBON POLLUTION. STUDY OF ITS CONSEQUENCES ON WILD MUSSELS (MYTILUS EDULIS) WITH RESPECT TO TIME ELAPSED SINCE THE POLLUTION [in French]
Fleckinger, R., G. Stevenin, and C. Rieucau. 1977.
Bulletin de L'Academie Veterinaire de France 50(1):79-84.

Fuel oil, Aromatic hydrocarbons, Detection, Mollusks, UK, *Mytilus edulis

Contamination of mussels by No. 3 fuel oil, resulting from an oil pollution event in the English Channel near Le Havre was examined. High levels of aromatic hydrocarbons and benzo[a]pyrene were detected 9 days after the spill but were no longer detectable by day 42.

[from Chemical Abstracts 87(13):#96964n. 1977]

C-0362-78
ANNUAL REPORTS ON ANALYTICAL ATOMIC SPECTROSCOPY, REVIEWING 1975
Fuller, C. W. 1976.
London, England, The Chemical Society, 1976. viii & 267p.

Chemical analysis, Spectroscopy, Petroleum products, Equipment

"This review covers recent developments in the instrumentation of analytical atomic spectroscopy and its application to elemental analysis in such areas as petroleum products, soils, plants, fertilizers, water and air pollution goods, body tissues and tissue fluids."

[from Biological Abstracts 65(3):#12810. 1978]

C-0363-78
THE ULTRASONIC DISPERSION SOURCE IDENTIFICATION, AND QUANTITATIVE ANALYSIS OF PETROLEUM OILS IN WATER
Gruenfeld, M., and R. Frederick. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:33-38.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntrye, and K. J. Whittle (eds.).

Chemical analysis, Source identification, Hydrocarbons, Dispersions

Three projects to develop methods for the quanitification and source identification of water-dispersed oils, and for preparing stable oil-in-water dispersions are discussed. Existing solvent extraction, IR quantification, and GC identification methods were utilized. New techniques involved: 1) a rapid adsorption method for separating hydrocarbons from other organics for more selective oil quantification; 2) inducing comparable volatility losses in milligram quantities of oils to enhance their source identification; and 3) preparing stable oil-in-water dispersions with known oil content, using an ultrasonic device.

C-0364-78
APPLICATION OF HIGH PRESSURE LIQUID CHROMATOGRAPHY TO THE ANALYSIS OF RESIDUAL LEVELS OF POLYCYCLIC AROMATIC HYDROCARBONS
Hunt, D. C., P. J. Wild, and N. T. Crosby. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:41-48.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Chromatography, PAH, Extraction, *HPLC, *Literature survey

A brief literature survey of the separation and estimation of polycyclic aromatic hydrocarbons (PAH) using high pressure liquid chromatography (HPLC) is presented. Suitable column packings, solvent systems, and detectors are evaluated. Discussions include methods of extracting PAH from different matrices, recovery data, and specimen chromatograms.

C-0365-78
APPLICATION OF CAPILLARY GAS CHROMATOGRAPHY IN THE ANALYSIS OF HYDROCARBONS IN THE ENVIRONMENT
Jeltes, R., E. Burghardt, Th. R. Thijsse, and W. A. M. Den Tonkelaar. 1977.
Chromatographia 10(8):430-437.

Hydrocarbons, Chromatography, Biodegradation, Monitoring

Capillary gas chromatography was used to monitor air, soil, and water pollution by hydrocarbons. This method was also used to characterize oil pollution and determine the rate of biodegradation of spilled oil.

[from Chemical Abstracts 87(24):#188661q. 1977]

C-0366-78
DETERMINATION OF ORGANIC SUBSTANCES POLLUTING WATER, AS A PART OF THE PROTECTION OF THE ENVIRONMENT [English summary]
Kubelka, V., J. Mitera, J. Novák, and J. Mostecký. 1977.
Chemické Listy 71(3):241-284.

Chemical analysis, Detection, Contaminants, Environmental protection

Summary not available.

[from Current Contents: Physical & Chemical Sciences 17(17): 81. 1977]

C-0367-78
THERMOANALYTICAL MEASUREMENTS IN THE FIELD OF WATER POLLUTION CONTROL
Literathy, P., and F. Laszlo. 1975.
Thermal Analysis, Proceedings of the 4th International Conference, 1974. I. Buzas (ed.). London, England, Heyden Publishers, 1975. Vol. 3:115-125.

Analytical techniques, Crude oil, Sediments, Detection, Source identification, *Thermal analysis

Thermal analysis is useful for identifying oil and other organic substances in bottom sediments, or adsorbed onto suspended particulates. Thermal analysis is rapidly conducted, and in the case of accidental pollution the method permits source identification. Combined with other analytical methods thermal analysis is useful in obtaining quantitative information on oil pollution.

[from Chemical Abstracts 87(10):#72934b. 1977]

C-0368-78
DETERMINATION OF THE AQUEOUS SOLUBILITY OF POLYNUCLEAR AROMATIC HYDROCARBONS BY A COUPLED COLUMN LIQUID CHROMATOGRAPHIC TECHNIQUE
May, W. E., S. P. Wasik, and D. H. Freeman. 1978.
Analytical Chemistry 50(1):175-179.

Chemical analysis, Chromatography, PAH, Solubility

The title technique is described and critically evaluated. The method is designed to avoid problems with adsorption onto container walls and can generate known concentrations of slightly soluble organic compounds in water. The solubilities and the temperature dependencies of the solubility of some PAHs have been measured, with the precision of replicate measurements and day to day reproducibility of better than ±3%. "In water pollution control, such information is helpful in devising abatement processes, in modeling natural water systems, in designing toxicity experiments, and in developing analytical techniques."

C-0369-78
MARINE POLLUTION BY OIL (book review)
Morris, A. W. 1975.
The Journal of Applied Ecology 12(3):990.

Analytical techniques, Chemical analysis, Sampling, Source identification, Book review

The title book [Institute of Petroleum Oil Pollution Analysis Committee. London, Applied Science Publishers, for the Institute of Petroleum (Great Britain), 1974. ix + 198p. Characterization of Pollutants, Sampling, Analysis and Interpretation] is unfavorably reviewed. It is suggested that the subtitle is more appropriate than the generalized title, and that whereas the book is intended for environmentalists, the only beneficial chapters are the ones describing the types of pollutant found, and the interpretation of the results of analytical procedures. The book deals predominantly with the details of 13 standard analytical methods, excludes analysis of trace amounts of dispersed oil, and only cursorily introduces the topic of weathering.

C-0370-78
PARTICULATE HYDROCARBON MATERIAL IN OCEAN WATER
Morris, B. F., J. N. Butler, T. D. Sleeter, and J. Cadwallader. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:107-116.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Chemical analysis, Source identification, Tar, Sargasso Sea

Sea water samples from the upper 100 m of the Sargasso Sea were analyzed for hydrocarbons bound in particulate form. Filtered extracts showed characteristics similar to the paraffinic wax inclusions found in pelagic tar lumps but different from those expected from many biogenic sources.

C-0371-78
DETERMINATION OF PETROLEUM PRODUCTS IN SOIL [in Russian]
Potapov, M. P., and L. A. Lukas. 1976.
Gigiena i Sanitariya No. 9:71-72.

Petroleum products, Soil, Chemical analysis, Adsorption

"A method in which petroleum product fractions are extracted by chloroform and hexane from soil suspensions is described. The method is used for sanitary-hygienic assessment of soils and their capability of adsorbing petroleum products on their surface."

[from Abstracts on Health Effects of Environmental Pollutants 6(9):#9445. 1977]

C-0372-78
THE EVALUATION OF WASTEWATERS FROM AN OIL SAND EXTRACTION PLANT
Strosher, M. T., and E. Peake. 1976.
Calgary, Alberta, Canada, The Environmental Sciences Centre (Kananaskis), The University of Calgary, 1976. 103p. Publication No. 76-35. Report to the Alberta Oil Sands Environmental Research Program, September 1976. AOSERP Report 5.

Chemical analysis, Wastewaters, Hydrocarbons, Tar sands, Canada, *Oil sands extraction plant

The organic constituents of wastewaters from the existing oil sands extraction plant at Athabasca were quantified and characterized for 21 chemical parameters. Hydrocarbon content in the extractable material of samples was 0.04% for tailings pond filter system effluents, and 7% for the upgrading plant discharges.

C-0373-78
NEW PRODUCTS: OIL-IN-WATER ANALYSIS (product information)
[Teledyne]. 1978.
Offshore 38(2):183.

Analytical techniques, Product information, *Oil-in-water analysis, *Photometers, *Teledyne

Oil-in-water analysis techniques using single wavelenth UV photometers and chopped beam dual wavelength photometric analyzers are available in a brochure from Teledyne.

6. SOURCE IDENTIFICATION

C-0374-78
INFRARED SPECTROSCOPY HELP[S] IDENTIFY OIL SLICKS (news brief)
Anon. 1977.
Water & Wastes Engineering 14(11):15.

Source identification, Oil slicks, Weathering, Spectroscopy

Research by C. W. Brown, P. F. Lynch, and M. Ahmadjian of Rhode Island University has demonstrated the feasibility of using infrared spectroscopy in fingerprinting oil slicks. In experiments, 85 different oils were artificially "weathered" for two weeks, and their weathered and unweathered spectra compared by computer methods. The technique promises to be most effective for samples collected within one week of spillage.

C-0375-78
ROUND-THE-WORLD NEWS: UNITED STATES (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(2):34.

Source identification, Pollution control, USCG

A national oil spill identification program under the US Coast Guard has been established to trace the source of pollution incidents.

C-0376-78
USCG OIL IDENTIFICATION LABS OPENED IN GROTON, CONN. (news brief)
Anon. 1978.
Sea Technology 19(1):45.

Source identification, Chemical analysis, USCG, Compensation, Connecticut

The Coast Guard opened a Central Oil Identification Laboratory (COIL) where a "fingerprint" of spill samples can be produced by chemical analysis. A national network of laboratories is planned by the Coast Guard. The efforts of the labs will aid in the identification of spillers and the recovery of costs of spill cleanup.

C-0377-78
THE FLUX OF LIGHT HYDROCARBONS INTO THE GULF OF MEXICO VIA RUNOFF
Brooks, J. M. 1977.
Marine Pollutant Transfer. H. L. Windom, and R. A. Duce (eds.). Lexington, MA, Lexington Books, D. C. Heath and Company, 1977. p. 185-200.

Source identification, Hydrocarbons, Production, Mexico/Gulf of, Mississippi River

Light gaseous hydrocarbons (methane through pentanes) are sensitive indicators of petroleum pollution. Natural processes cannot account for the occurrence of light hydrocarbons in the Gulf of Mexico, and thus they must enter chiefly from man-derived sources, river runoff, and/or across the sea/air or sea/sediment interface. In particular, light hydrocarbons in the Mississippi River originate predominantly from petroleum and petrochemical activities. Significant impacts on coastal waters are evidenced by hydrocarbon anomalies seen from 16-32 km (10-20 mi) off port and up to 80 km (50 mi) off the Mississippi River.

C-0378-78
USE OF PATTERN RECOGNITION TECHNIQUES FOR TYPING AND IDENTIFICATION OF OIL SPILLS
Curtis, M. L. 1977.
Report USCG-D-38-77, Contract DOT-CG-81-75-1383, 21p. Final report.

Source identification, Spectroscopy, Detection, *UV fluorescence

A study was conducted to set up identification procedures based on ultraviolet fluorescence spectra of oils and to determine whether or not techniques used for infrared analysis could be applied to the fluorescence spectra interpretation. Reading peak and valley amplitudes alone do not produce good identification. An algorithm for assigning a sharpness factor to valleys and peaks has been developed for a computer program which results in very reliable identification.

[from Government Reports Announcements 77(23):#AD-A043 802/8GA. 1977]

C-0379-78
SPLITLESS INJECTION ON GLASS OPEN TUBULAR (CAPILLARY) COLUMNS
Hartigan, M. J., B. Giordano, and L. S. Ettre. 1977.
Chromatography Newsletter 5(2):24-27.

Source identification, Oil spills, *Splitless injection

"An all-glass splitless sample injection system is described and its performance is demonstrated with glass wall-coated open tubular columns for the identification of oil spills."

[from Chemical Abstracts 87(26):#203905t. 1977]

C-0380-78
ENVIRONMENTAL OIL POLLUTION IDENTIFICATION [in Japanese]
Higashi, K., and K. Hagiwara. 1977.
Mizu Shori Gijutsu 18(5):429-437.

Source identification, Contaminants, Hydrocarbons, Chemical analysis, Analytical techniques

"A review with 38 references."

[from Chemical Abstracts 87(20):#156722u. 1977]

C-0381-78
CHARACTERIZATION OF OIL SPILLS BY CAPILLARY COLUMN GAS CHROMATOGRAPHY
Matsunaga, K., T. Ishida, and T. Oda. 1976.
Analytical Chemistry 48(9):1421-1423.

Source identification, Chromatography, Crude oil, Fuels

Chromatograms of crude oils, bunker fuels, and oil spills with respective GC patterns are presented after analysis with a 100 ft Dexsil-300 support coated open tube column. All were dominated by the n-paraffins, with up to 13 resolved, but unidentified, smaller peaks appearing between the n-paraffin peaks of adjacent C numbers. Using less than 2 hours of analysis time, this technique identifies oil spills, analyzes samples as liquids or solids with very little pretreatment, and is compatible with computer assisted data retrieval.

[from Maritime Research Information Service Abstracts Vol. 15: #14 148185. 1977]

C-0382-78
FINGERPRINTING OIL SPILLS
Schlich, V. 1976.
Defenders 51(3):399.

Source identification, Oil spills, Chemical analysis, USCG, Spectroscopy, Chromatography

A case history is presented of a successful attempt by the US Coast Guard to identify the source of an oil slick off Florida in 1975, and to arrest the polluter under the federal Water Pollution Control Act. Some of the fingerprinting techniques, which involve fluorescence- or IR spectroscopy, and gas- or thin layer chromatography, were developed for the Coast Guard by University of Rhode Island researchers C. W. Brown, M. Ahmadjian and P. Lynch.

B. OIL POLLUTION PREVENTION AND CONTROL

1. SPILL CONTAINMENT

C-0383-78
CONTROLLING POLLUTION
Anon. 1977.
Offshore Fishing, May:133-135.

Spill containment, Booms, Equipment, Product information, Tankers, Pollution control, *Lucan boom

"A description is given of the Lucan bottom tension oil spill control boom, and details of its construction and use are given. It is suggested that all oil tankers should be equipped with their own oil spill booms."

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13539. 1977]

C-0384-78
HYDRODYNAMICS OF CONTAINED OIL SLICKS
(Author unknown). 1976.
Ph.D. Thesis, Massachusetts Institute of Technology, Department of Ocean Engineering, 1976.

Spill containment, Oil slicks, Models, *Hydrodynamics

"As a first step in understanding the instabilities which are observed when oil is contained in the presence of a sheer flow, the problem of finding the mean shape of a pool of oil in front of a barrier moving in water of infinite depth is considered. The author presents experimental evidence that this problem is one of a gravity current in which no head loss takes place outside of a relatively thin boundary layer, and that irrotational flow theory can be used in the water phase." Details are given, including an equilibrium equation and numerical solutions for friction distributions.

[from Maritime Research Information Service Abstracts Vol. 15: #14 142339. 1977]

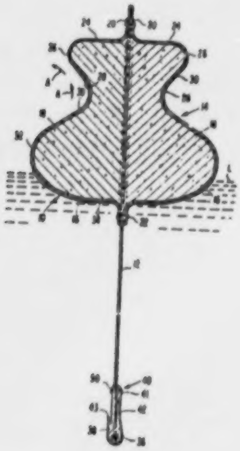
C-0385-78
FLOATING BOOM
[Cascade Industries]. 1977.
US Patent 4,030,304

Spill containment, Booms, Equipment, Patent

"The boom for restricting the movement of buoyant material [oil on water] beyond a predetermined area on a water surface has an elongated, flexible skirt with float means attached to the upper longitudinal edge to support the skirt disposed in a manner to act as a barrier for confining pollutants. The skirt is made from sections which are connected at their ends to provide a continuous boom and an elongated, flexible tension element extends along the lower, fully immersed skirt edge."

[from Underwater Information Bulletin 9(6):44. #77/12/41. 1977]

4,030,304
FLOATING BOOM
Robert E. West, Yardley, Pa., assignor to Cascade Industries, Incorporated, Edison, N.J.
Filed Mar. 17, 1976, Ser. No. 667,784
Int. Cl.^{2} E02B ***15/04, 3/00***
U.S. Cl. 61—1 F **1 Claim**



C-0386-78
OIL SPILL CONTAINER (product information)
[Environetics.] 1978.
Offshore 38(4):141.

Spill containment, Booms, Product information, *Boa-Boom II

The Boa-Boom II, manufactured by Environetics, is designed to contain oil spills and serve as an oil slick barrier. The product is capable of maintaining oil slicks with up to 9 km/hr (5 kn) currents and 36 km/hr (20 kn) winds.

C-0387-78
NEW AIRBORNE SYSTEM CONTAINS OIL SPILLS FAST
[Evergreen Air]. 1977.
Oil & Gas Journal 75(37):126.

Spill containment, Design-engineering, Product information, *Oil collectant dispenser

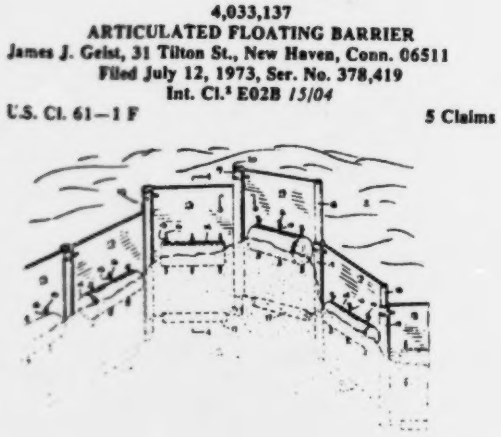
A helicopter-portable airborne application system for oil spill containment comprises a tank provided with spray booms and necessary motorized gear, which dispenses a collectant formulation around a spill to prevent further spreading. The system is available from Evergreen Air of Montana, Box 4345, Missoula, MT 59806.

C-0388-78
ARTICULATED FLOATING BARRIER
Geist, J. J. 1977.
US Patent 4,033,137

Spill containment, Booms, Equipment, Patent

A barrier for containing floating oil is described, which has rectangular, buoyant sections, fastened together in such a manner as to contain oil while allowing wave-generated motion to occur.

[from Underwater Information Bulletin 9(6):45. #77/12/59. 1977]



4,033,137
ARTICULATED FLOATING BARRIER
James J. Geist, 31 Tilton St., New Haven, Conn. 06511
Filed July 12, 1973, Ser. No. 378,419
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 61—1 F **5 Claims**

C-0390-78
OIL-DEFENCE BOAT CAN RACE TO SPILL SCENE (product information)
[Vator Oy Co.] 1978.
Water & Pollution Control 116(1):34.

Spill containment, Pollution control, Booms, Equipment, Product information, *Vator Oy Co.

The Vator 18T oil defense boat, developed by Vator Oy Co. of Helsinki, Finland is briefly described. The boat is capable of speeds up to 56 km/hr (30 knots) and is equipped with a floating plastic boom that can be deployed around a spill at the rate of 10 m/minute. The boom, called the Nokia SUP Spillboom is produced by the Cable Works Division of OY Nokia AB.

2. CLEANUP AND RECOVERY

C-0391-78
UNTITLED (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(12):268.

Absorption, Spill cleanup, *Forbent, Product information

A non-toxic, organic compound, called Forbent, has been developed by the Posteor organization, Gdansk Forbent is claimed to instantly absorb oil or oil products on the surface of water without sinking. It can then be removed by using special nets.

C-0392-78
DRACONE BARGE INTRODUCED BY DUNLOP
Anon. 1977.
Holland Shipbuilding 26(2):78.

Spill recovery, Storage, Design-engineering, Product information, *Dracone barge

The Dunlop GRG Division of Skermersdale, England, has introduced a 4,500 L-capacity barge, used for the collection and storage at sea of salvaged oil. The barge is made of rubberized fabric and can be airlifted to the spillage area for spill cleanup; conversely it can be used to bring concentrated dispersant to the spill area.

[from Aquatic Science & Fisheries Abstracts 7(9):#7Q11789. 1977]

C-0393-78
MOPPING UP OIL SPILLAGE
Anon. 1977.
Ship & Boat International 30(6):41-43.

Skimmers, Spill recovery, UK, Equipment, Product information

Oil Recovery International of Christchurch, Hampshire, UK, has developed skimming equipment for oil spill cleanup and recovery. The largest unit can recover up to 75 bbl oil/hr with a water content between 5 and 15%. Smaller units are adaptable for land-based or shipboard operation.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11801. 1977]

C-0394-78
NEW NORWEGIAN SKIMMER TO CLEAR OIL SPILLS (news brief)
Anon. 1977.
Motor Ship 58(682):90.

Spill cleanup, Skimmers, Equipment, Product information, Design-engineering, *Euroskimmer

The Euroskimmer, jointly developed by 3 European companies, is a self contained unit designed to clean up small to large quantities of crude oil from the ocean surface even under waves up to 2.5 m height, wind speeds up to 10 m/sec, and in 2.6 km/hr (1.5 knot) tidal currents. The unit incorporates a catamaran design and utilizes containment booms and rotating disk skimmers to recover the oil.

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13417. 1977]

C-0395-78
[NEW SKIMMER FROM FRANK MOHN]
Anon. 1977.
Offshore Engineering No. 6:72.

Skimmers, Spill recovery, Ekofisk blowout, North Sea, Equipment, Product information

A new skimmer, developed by Frank Mohn of Norway, was field tested and proven highly successful during the Ekofisk Bravo blowout during April 1977. The skimmer recovered about 1500 tons of oil at up to 3.5 m waves.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11798. 1977]

C-0396-78
PROSPECT OF OPEN-SEA WORKING
Anon. 1977.
Ship & Boat International 30(6):43.

Spill recovery, Design-engineering, Equipment, Product information, *Field testing

The Ekofisk blowout demonstrated the need for more effective oil recovery equipment, and Oil Recovery International believe their equipment will fill that need. Initial testing of the spill recovery equipment has proven 100% effective, and additional sea trials are underway.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11802. 1977]

C-0397-78
ROUGH-WEATHER RESPONSE STUDIED (news brief)
Anon. 1978.
Sea Technology 19(3):27.

Spill cleanup, USCG, *Seaward International, Inc., *Rough-weather response

Seaward International, Inc., Falls Church, VA, received a Coast Guard contract to study state-of-the-art oil pollution response technology, and to determine the best available systems for extreme-weather incidents.

C-0398-78
SKIMMERS OR DISPERSANTS (news brief)
Anon. 1977.
Offshore England No. 6:27.

Skimmers, Equipment, Dispersants, Ekofisk blowout

Of the skimmers used during the Ekofisk blowout, the Framo skimmer appears to have been more successful than the Vikoma. Two types of dispersants are currently in use; one is based on hydrocarbon solvents, which is going out of fashion, the other is based on concentrates of an oxygenated solvent such as alcohol or glycol. The application of these dispersants is discussed.

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13418. 1977]

C-0399-78
SKIMMERS SUCCESS IN BRAVO BLOWOUT
Anon. 1977.
Offshore Services 10(6):44.

Skimmers, Spill recovery, Product information, Ekofisk blowout, North Sea, *Framo skimmer

During the April, 1977, Ekofisk Bravo blowout, the Framo oil skimmer successfully operated at Force 5 winds and 3-4 m waves and recovered an estimated 1800 tons of oil. The skimmer and its operation are described.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q1197. 1977]

C-0400-78
OIL SKIMMER STANDS FREE, OR MOUNTS ON TANK (product information)
[Aerodyne Development Corporation]. 1977.
Chemical Engineering 84(19):114.

Oil-water separation, Skimmers, Oil tanks, Equipment, Product information

A portable oil skimmer which removes up to 30 L per hour (8 gph) of oily wastes from tanks is described. The device uses an oleophilic metal pickup-belt and removes less than 5% water with the oil. The device is available from the Aerodyne Development Corporation, Cleveland, Ohio.

C-0401-78
ON THE EFFICIENCY OF INDIAN POLYURETHANE FOAMS IN ABSORBING SPILLED OIL
Bhandare, M. V., and R. Sen Gupta. 1976.
Mahasagar 9(1-2):67-69.

Absorption, Fuel oil, Spill cleanup, *Polyurethane foam

"The oil-absorbing power of polyurethane foam sheets and foam powder, manufactured in India, was tested using diesel oil on sea water. The sheets absorbed 72% and the powder 55% of their weight. With increased amounts of oil, the absorbing power decreased."

[from Chemical Abstracts 87(24):#189074n. 1977]

C-0402-78
OIL SPILL DISPERSANT (product information)
[Drew Chemical Corporation]. 1978.
Journal Water Pollution Control Federation 50(1):34a.

Spill cleanup, Dispersants, Product information

"Ameroid Oil Spill Dispersant/LT is a low toxic, oil spill dispersant formulated to combat oil spilled in fresh or salt water. It consists of a blend of wetting agents and solvents which transforms oil to a relatively harmless state that is biodegradable and non-toxic to marine life." Contact Drew Chemical Corporation, 701 Jefferson Rd., Parsippany, NJ 07054.

C-0403-78
METHOD AND APPARATUS FOR REMOVING OILS AND THE LIKE FLOATING ON A LIQUID
Ehrler, P., and J. Janitza. 1976.
German Offenlegungsschriften (unexamined patent application) 2,609,847

Spill cleanup, Absorption, Patent, Equipment, *Polypropylene

"Oil is removed from the water surface by two endless belts made of unmodified polypropylene." The belts are pressed against each other by rotating drums. The oil squeezed out is caught in pans and directed to a collecting vessel.

[from Chemical Abstracts 88(2):#11529x. 1978]

C-0404-78
DISPERSING AGENTS FOR OIL SLICK ON WATER
Exxon Research and Engineering Co. 1976.
Japanese Patent 76 30,030

Spill cleanup, Dispersants, Patent

A suitable dispersant is made from a mixture of a sorbitan monoacylate and a sorbitan monoacylate poly(oxyethylene) derivative.

[from Chemical Abstracts 87(12):#90422n. 1977]

C-0405-78
NEW PRODUCTS: FLOTATION SUPPORT (product information)
[Helle Engineering]. 1978.
Offshore 38(1):81.

Spill cleanup, Product information, *Helle Engineering, *Flotation support

Buoyant plastic spheres, 5 cm (2 in) in diameter, can be used for oil pollution recovery. Helle Engineering produce these spheres that provide about 410 kg/m^3 (25.5 lb/ft^3) of flotation support in sea water.

C-0406-78
APPARATUS FOR RECOVERING OIL FROM OIL-WATER MIXTURES
In'tVeld, C. 1977.
German Offenlegungsschriften (unexamined patent application) 2,652,632

Spill cleanup, Spill recovery, Oil-water separation, Oil slicks, Patent

Oil slicks are collected by a shipboard skimmer and boom arrangement and then transferred onboard by means of collection pipes. Onboard gravity separation, filtration and oil coalescence units then process the collected liquids to recover the oil.

[from Chemical Abstracts 87(12):#90404h. 1977]

C-0407-78
RECOVERY OF SPILLED OIL
Kawakami, K., and L. Moriyama. 1977.
Japanese Kokai (unexamined patent application) 77 80,291

Spill recovery, Seawater, Wastewaters, Patent, *Powdered plastics, *Foam

"Oils on natural, sea, and waste waters are collected by powdered plastics <1000 µ or foam of surface area >50 m^2/g."

[from Chemical Abstracts 87(24):#188950h. 1977]

C-0408-78
AGENT FOR SPILL CONTROL
Kondo, G., M. Kida, and T. Akazawa. 1976.
Japanese Kokai (unexamined patent application) 76,113,356

Spill cleanup, Petroleum products, Marine organisms, Patent

The agent is made up of a water insoluble C_{3-21} perfluoroalkyl, a solvent, and a liquid paraffin. It has a long shelf life and is inert to marine organisms. Oil removal rate is given at 28.5 cm^2/sec.

[from Chemical Abstracts 87(20):#156658c. 1977]

C-0409-78
CLEAN SWEEP SELECTED FOR COOK INLET DUTY (product information)
[Lockheed Missiles and Space Co.]. 1978.
Sea Technology 19(2):34.

Product information, Skimmers, Spill recovery, Alaska/Gulf of, *Clean Sweep skimmer

A consortium of major oil and pipeline companies, the Cook Inlet Response Organization (CIRO), located in Anchorage, Alaska, leased a Clean Sweep type 3100 to handle oil spills in upper Cook Inlet and Anchorage Harbor. The oil retrieval vessel, manufactured by Lockheed Missiles and Space Co., can recover up to 1325 L/min of oil (350 gpm). The vessel retrieves oil using an efficient process, based on a paddle wheel design, and is capable of recovering approximately 96% pure oil.

C-0410-78
OIL SPILL SKIMMER HEADS FOR PACIFIC STATION (product information)
[Lockheed Missiles and Space Co.]. 1978.
Chemical and Engineering News 56(5):28.

Product information, Spill recovery, Skimmers, Pacific Ocean, *Clean Sweep skimmer

Lockheed Missiles and Space Co. has manufactured for the Coast Guard a Clean Sweep oil retrieval device. The unit will be used on oil spills along the Pacific Coast and in waters of the US possessions in the Pacific. Lockheed claims the skimmer is capable of recovering about 4000 L/min (1000 gpm) of oil spilled in waves as high as 5 m (16 feet).

C-0411-78
MARINE OIL SPILLS
Lovell, A. H. 1976.
Waste Disposal and Water Management in Australia, July-August: 12-16.

Spill cleanup, Australia, Contingency planning, Government agencies, Oil industry, Dispersants

The threat of oil spills, national spill response plans and other oil pollution control measures are viewed from an Australian perspective. The Australian government has had a national contingency plan in effect since 1973, and the Australian oil industry has formed a Marine Oil Spills Action Plan designed to develop the most efficient clean-up methods. The use of dispersants appears to be the most widely applicable spill control tool available at the present time.

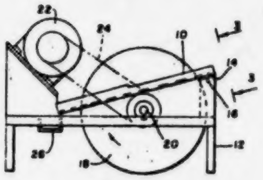
C-0412-78
OIL RECOVERY APPARATUS AND METHOD
Lowe, J. G., and R. I. Butler. 1977.
US Patent 4,051,024

Spill cleanup, Equipment, Patent, *Plastic disks

"An apparatus for cleaning up oil spills consists of plastic or plastic-coated disks mounted on a rotating shaft, which pick up the oil and transfer it to plastic scrapers from which it is led to a collector."

[from Chemical Abstracts 88(4):#27462f. 1978]

4,051,024
OIL RECOVERY APPARATUS AND METHOD
John G. Lowe, Pequannock, and Roy I. Butler, Kinnelon, both of N.J., assignors to Lowe Engineering Company, Lincoln Park, N.J.
Filed Jan. 29, 1976, Ser. No. 653,501
Int. Cl.^{2} B01D *15/02, 15/06*
U.S. Cl. 210—30 A **16 Claims**



C-0413-78
REMOVING PETROLEUM CONTAMINANTS FROM WATER
Marconi, W., R. Olivieri, L. Degen, and A. Robertiello. 1977.
German Offenlegungsschriften (unexamined patent application) 2,654,909

Petroleum products, Spill cleanup, Bacteria, Dispersants, Seawater, Freshwater, Patent

A description is given of a process for removing petroleum products from fresh or seawater by bacterial assimilation. A mixture, consisting of a nonionic dispersant, aldehyde derivatives, oxidizing agents, and inert carriers, is described, and forms the assimilating agent.

[from Chemical Abstracts 87(22):#172675m. 1977]

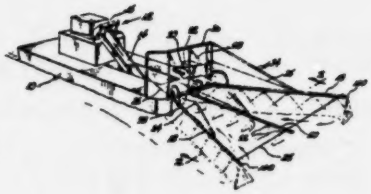
C-0414-78
OIL SPILL AND DIRECTING APPARATUS AND METHOD USING WATER SPRAY BOOMS
Marione Construction & Design Co. 1977.
US Patent 4,033,869

Spill cleanup, Booms, Patent, *Water spray booms

A method for moving spilled oil on water to a certain area is given. A water spray is directed at the edge of the oil, pushing it ahead of the spray, to the desired location. The spray characteristics are such as to prevent dispersing the oil.

[from Underwater Information Bulletin 9(6):46. #77/12/66. 1977]

4,033,869
OIL SPILL CONFINING AND DIRECTING APPARATUS AND METHOD USING WATER SPRAY BOOMS
Jay L. McGrew, Littleton, Colo., assignor to Marine Construction & Design Co., Seattle, Wash.
Filed June 5, 1974, Ser. No. 476,420
Int. Cl.^{2} B01D ***37/00***
U.S. Cl. 210—65 **15 Claims**



C-0415-78
OIL ABSORBENT
Matsuda, Y., S. Tomita, K. Terajima, K. Abe, et al. 1977.
Japanese Kokai (unexamined patent application) 77 76,287

Absorption, Spill cleanup, Patent, *Pine chips

An absorbent for treating oil spills was made from ground pine chips, $\leq$16x2 mm, which were treated with rosin size 3, paraffin wax, and $ZrOCl_2$ per 5% weight of wood. The product was dried at 80-90°, and when done, absorbed 20 times its weight of heavy oil.

[from Chemical Abstracts 87(22):#169461h. 1977]

C-0416-78
OIL ADSORBER FROM PULP FIBER
Matsuda, Y., S. Tomita, K. Terajima, and K. Abe. 1977.
Japanese Kokai (unexamined patent application) 77 21,477

Adsorption, Spill cleanup, Patent, *Pine pulp

"Pinewood pulp slurry (freeness 500 ml) was stirred with rosin 3, paraffin wax emulsion 15, and $ZrOCl_2$ 5%, dehydrated, and dried at 80-90° to give an efficient adsorbent for oil spills."

[From Chemical Abstracts 87(24):#188934f. 1977]

C-0417-78
OIL ADSORBER FROM WOOD CHIP
Matsuda, Y., S. Tomita, K. Terajima, K. Abe, et al. 1977.
Japanese Kokai (unexamined patent application) 77 76,286

Adsorption, Spill cleanup, Patent, *Pine chips

An oil adsorbent made of pine chips is described. The 16x2 mm chips were sized with rosin, dehydrated, dried, and sprayed with paraffin wax. The end product is used as adsorbent for heavy oil spills.

[from Chemical Abstracts 87(20):#156683g. 1977]

C-0418-78
CONTROL OF DISPERSION OF OIL SPILLS USING AN OIL COLLECTING AGENT [in Japanese]
Murakami, Y., K. Hagiwara, T. Saito, Y. Ozasa, et al. 1977.
Osaka Kogyo Gijutsu Shikensho Kiho 28(1):12-17.

Spill recovery, Surfactants, Toxicity, Dispersions

Four surfactants were tested for effectiveness in oil spill recovery from water. Rank order and toxicity are discussed.

[from Chemical Abstracts 87(24):#186764b. 1977]

C-0419-78
HARBOR OIL SPILL REMOVAL/RECOVERY SYSTEMS: PHASE II - EXECUTIVE SUMMARY
Naval Civil Engineering Laboratory. 1976.
Report No. Y41-21-001-01-001, July 1976. 14p.

Spill cleanup, Spill recovery, Harbors, Booms, Skimmers, EPA, *Tests

"Objectives of Phase II were to develop standard performance test procedures applicable to the EPA Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility. Standard test procedures for booms and skimmers were developed and validated. A support system for deploying and retrieving oil containment booms was identified, and a boom with a frontal screen to improve the oil containment was fabricated and tested."

[from Maritime Research Information Service Abstracts Vol. 15: #14 142921. 1977]

C-0420-78
SCIENTIFIC PRINCIPLES OF METHODS AND MEANS FOR PREVENTING THE POLLUTION OF THE SEA BY OIL
Nesterova, M. P. 1976.
Ambio Special Report No. 4:237-240.

Spill cleanup, Pollution prevention, Oil tanks, Emulsions, Absorption, *Detergents

A closed-cycle cleaning technique for oil tanks uses detergents which produce unstable emulsions that decompose spontaneously. Another technique was developed for localizing, corraling, and absorbing oil spills.

[from Chemical Abstracts 88(4):#27626n. 1978]

C-0421-78
OIL ABSORBER
Sakai, Y. 1977.
Japanese Kokai (unexamined patent application) 77 08,998

Spill cleanup, Absorption, Patent, *Coconut shell

Granular or finely powdered coconut shell can be used for absorbing oil spills.

[from Chemical Abstracts 87(12):#87069x. 1977]

C-0422-78
CRYOTHERMAL MANIPULATION OF PETROLEUM SPILLS ON WATER
Shuffman, R. 1977.
US Patent 4,031,707

Petroleum products, Spill cleanup, Booms, Equipment, Patent, *Cryothermal material

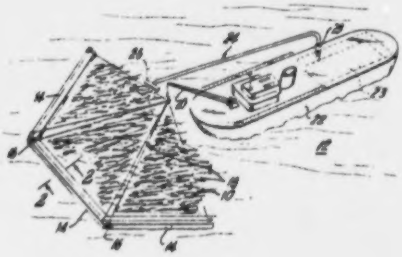
The method for recovering petroleum spilled on water uses elongated booms with a temperature lower than the temperature of the petroleum. The cryothermal material increases surface tension of adjacent petroleum, causing it to move toward a removal area.

[from Underwater Information Bulletin 9(6):44. #77/12/51. 1977]

4,031,707
CRYOTHERMAL MANIPULATION OF PETROLEUM SPILLS ON WATER

Signund Lance Ross, deceased, late of 1 Cornell St., Scarsdale, N.Y., by Rose Shuffman, executive, Scarsdale, N.Y., and Oscar Shuffman, 2761 Sedgwick Ave., New York, N.Y., assignors to Rose Shuffman, Executrix, Scarsdale, N.Y.

Filed Apr. 24, 1972, Ser. No. 246,960
Int. Cl.^{2} E02B *3/00*
U.S. Cl. 61—1 F **8 Claims**



C-0423-78
OIL SKIMMER (product information)
[Skim Inc.]. 1978.
Offshore 37(13):167.

Product information, Skimmers, Spill cleanup, *Skim Inc.

Skim Inc. is marketing a self-sufficient oil skimmer that can remove a range of oil thicknesses. The skimmer is designed for emergency standby use on drilling platforms, boats, and docks.

C-0424-78
TREE BARK - A USABLE COMMODITY
Smith, J. E., and R. R. M. Patterson. 1976.
Process Biochemistry 11(6):41,42,44-48.

Spill cleanup, Absorption, Product information, *Tree bark chips

Among the many uses for bark which have not yet been fully developed is the application of chopped bark for absorbing oil spills on water.

[from Applied Ecology Abstracts 3(8):#3D-9522. 1977]

C-0425-78
OIL ADSORBENT
Takahashi, R., T. Sone, and T. Hirata. 1977.
Japanese Kokai (unexamined patent application) 77 31,992

Spill cleanup, Adsorption, Patent, *Sorbent foam

"Porous oil adsorbent foams useful in spill recovery are made by mixing 100 parts of certain block copolymers with 3-500 parts oil having viscosity-specific gravity constant 0.79-1.05, and optionally 200 parts olefin or its copolymer, diene or its copolymer, or filler."

[from Chemical Abstracts 87(10):#73196z. 1977]

C-0426-78
OIL SPILL CLEANUP (product information)
[3M Co.]. 1978.
Offshore 38(1):76.

Product information, Absorption, Spill cleanup, *Viscous Oil Sorbent Type 356

Viscous Oil Sorbent Type 356, manufactured by 3M Co., is most effective in cleaning up heavy viscosity oil spills and deposits, such as Bunker C, No. 6, and others. Each oil sorbent pad weighs 85 g (3 oz) and will absorb 50-250 times its weight depending on oil viscosity.

C-0427-78
OIL ADSORBENT
Tsukahara, M. 1977.
Japanese Kokai (unexamined patent application). 77,101,683

Adsorption, Seawater, Patent, *Resin filament

"An oleophilic synthetic resin filament is cut by a crusher and partly welded to each other by the friction heat to form pellets." The resulting adsorbent, stirred in seawater and heavy oil, adsorbed 12 times the resin volume of liquid containing 98% oil.

[from Chemical Abstracts 88(4):#27463g. 1978]

C-0428-78
NEW PRODUCTS (product information)
[Vikoma International Ltd]. 1978.
Spill Technology Newsletter 3(1):7.

Spill cleanup, Equipment, Product information, Booms, *Vikoma Oceanpack

Vikoma International Ltd. announces the development of the Vikoma Oceanpack, a boom system for the vigorous ocean environment. Included is a vessel which holds 500 m of the rapidly deployed, inflatable boom. More information is available from Marine Equipment Ltd., 3695 Barrington St., Halifax, Nova Scotia B3K 2Y3, Canada.

3. RESTORATION

C-0429-78
HELP! (news brief)
Anon. 1977.
Audubon 79(6):101.

Restoration, Birds, Oil spills, Manuals, *Care & treatment

The New York Zoological Society has published "Help! A Step-by-Step Manual for the Care and Treatment of Oil-Damaged Birds". This illustrated handbook details proven methods for raising the survival rates of oil-coated birds in rescue efforts carried out by amateurs or professionals. For a copy of this brochure write to the New York Zoological Society, Bronx, NY 10460.

C-0430-78
HELP! A STEP-BY-STEP MANUAL FOR THE CARE AND TREATMENT OF OIL-DAMAGED BIRDS
Dolensek, E. P., and J. Bell. n.d.
Bronx, New York, New York Zoological Society, n.d. n.p.

Restoration, Birds, Wildlife, Manuals, Guidelines, *Oiled animals, *Care and treatment

". . . This book, outlining various methods for saving birds and wildlife caught in [oil spill] disasters, is a valuable aid. The publication details techniques to remove the oil, includes aids to identify species, instructions for keeping wild birds, and guidelines for proper veterinary treatment." It is available for 50¢ from Help!, Publications Department, New York Zoological Society, Bronx, N.Y. 10460.

[from Conservation News 42(24):15. 1977]

C-0431-78
RECOVERY AND RESTORATION OF DAMAGED ECOSYSTEMS (book review)
Fee, E. J. 1977.
Journal of the Fisheries Research Board of Canada 34(12): 2425-2426.

Restoration, Oil spills, Ecosystems, Book review, *Ecological disasters

The title book [Cairns, J., Jr., K. L. Dickson, and E. E. Herricks (eds.). Charlottesville, Virginia, The University Press of Virginia, 1977. x + 531p.] is critically reviewed and criticized for the arrangement of the articles: ". . . it was a mistake to try to include such a broad array of topics in a single volume." Many ecological disasters, including oil spills, are presented and discussed.

4. OIL TRANSFER AND TRANSPORT

C-0432-78
COAST GUARD PROPOSES REQUIREMENTS FOR REDUCING OIL POLLUTION FROM TANKERS
Anon. 1977.
Environment Reporter 8(6):235-236.

Regulations, USCG, Tankers, Segregated ballast, Pollution control, *Double bottoms, *Emergency steering

The US Coast Guard has proposed regulations requiring oil tankers entering U.S. ports to be equipped with double bottoms, segregated ballast, and emergency steering capability. Double bottoms would be required of new tankers built after 1979, and segregated ballast systems would be required by 1983. The emergency steering provisions will go into effect one year after finalization of the regulations.

C-0433-78
HOVERING STORAGE TANKS IN JAPAN
Anon. 1976.
Transport Development News 1976:26-27.

Oil tanks, Storage, Pollution prevention, Japan, *Air cushion movement

Severe pollution damage to Japanese fishing resources caused by a large oil slick from a cracked storage tank at a Mitzushima refinery has prompted a survey of all storage tanks in the country. So far 500 have been found to be unsafe and many of these will be lifted or moved by the air-cushion method while their foundations are reconstituted. The air cushion system of moving tanks was developed by the Southampton-based company Air Cushion Equipment, Ltd.

[from Maritime Research Information Service Abstracts Vol. 15: #07 142642. 1977]

C-0434-78
THE PROBLEMS CONNECTED WITH THE DEVELOPMENT OF A MAJOR OIL PORT IN A NON-INDUSTRIAL ENVIRONMENT
Dudley, G. 1977.
Oceanic Management - Conflicting Uses of the Celtic Sea and Other Western U.K. Waters. M. M. Sibthorp, and M. Unwin (eds.). London, Europa Publications, 1977. p. 192-212. Report of a Conference held at University College of Swansea, 19-22 September 1975.

Ports, Harbors, Oil transfer, Environmental effects, Statistics, Pollution control, UK, *Milford Haven

The post-WWII development of Milford Haven into the UK's largest port is related to the enormous increases of oil consumed by the UK in the last two decades. This paper summarizes the general effects of this development on fisheries, marine flora and fauna, recreation, tourism, and visual impact, and reviews statistics on Milford Haven's experience in regard to oil pollution. Statistics indicate that only 0.5 tons of oil are spilled for every million that are handled. The main causes of pollution in the harbor are enumerated, and pollution control measures are listed.

C-0435-78
ALASKAN OIL TRANSPORTATION ISSUES
Environmental Protection Agency. 1977.
Washington, D.C., EPA Office of Research and Development, 1977.
Report EPA-600/9-77-019. 11p. (EPA Decision Series).

Oil transport, Pipelines, Tankers, Environmental deterioration, Water quality, Alaska, US, EPA

Now that the trans-Alaska pipeline is operational, several environmental issues related to the movement of Alaskan oil to the western US must be addressed. This document highlights some of the serious environmental problems related to air, water, and land quality that are concomitant to the transport and distribution of the Alaskan oil in the US.

C-0436-78
ANALYSIS OF BRINE DISPOSAL IN THE GULF OF MEXICO. (3) CAPLINE SECTOR
Federal Energy Administration. 1977.
Report NOAA-77072523. 201p.

Storage, Disposal, Mexico/Gulf of, Louisiana, *Salt domes, *Brine discharge

It is proposed by the FEA to use crude oil storage caverns leached out of salt domes in the Capline Sector at Weeks Island and Chacahoula along the Louisiana coast. Discharge into the Gulf of Mexico is suggested as a means of disposing of the saturated brine to be produced as additional caverns are solution-mined. The potential environmental impact of this disposal is examined.

[from Government Reports Announcements 77(22):#PB-271 292/5GA. 1977]

C-0437-78
STRATEGIC PETROLEUM RESERVE: CENTRAL ROCK MINE
Federal Energy Administration. 1977.
Report FEA/S-77/214, FES-76/77-9. 515p. Final environmental impact statement.

Storage, EIS, Water quality, Socio-economic effects, *Strategic Petroleum Reserve

The proposed storage of oil at Central Rock Mine would use an existing underground limestone mine presently owned and operated by the Central Rock Company. This EIS has identified 3 particularly sensitive environmental parameters: water quality, air quality, and socioeconomic factors.

[from Government Reports Announcements 77(22):#PB-270 447/6GA. 1977]

C-0438-78
STRATEGIC PETROLEUM RESERVE. DRAFT SUPPLEMENT. BRYAN MOUND SALT DOME
Federal Energy Administration. 1977.
Report FEA/S-77/211, FES-76/77-6-Suppl. 383p. Final environmental impact statement. Supplement to Report PB-262 839, dated Jan. 1977.

Storage, EIS, *Strategic Petroleum Reserve

"This document is a draft supplement to the final environmental impact statement (EIS) for an underground crude oil storage facility at the Bryan Mount salt dome located in Brazaria County, Texas."

[from Government Reports Announcements 77(22):#PB-270 108/4GA. 1977]

C-0439-78
STRATEGIC PETROLEUM RESERVE PLAN. AMENDMENT NO. 1. ACCELERATION OF THE DEVELOPMENT SCHEDULE
Federal Energy Administration. 1977.
Report FEA/S-77/225, Energy Action No. 12. 70p.

Storage, Cost analysis, Environmental effects, Economic effects, *Strategic Petroleum Reserve

This Amendment presents an accelerated schedule for the development of the Strategic Petroleum Reserve. The benefits and costs are estimated, and the economic and environmental impacts are assessed.

[from Government Reports Announcements 77(21):#PB-269 810/8GA. 1977]

C-0440-78
FUEL OILS [in Japanese]
Kosugi, M., T. Anezaki, C. Machida, and T. Yoshzawa. 1976.
Sekiyu Gakkai Shi 19(7):540-544.

Petroleum products, Storage, Oil transport, Refining, Oil spills, Fuel oil, Fuels

"A review with 38 references, on gasoline, diesel fuel, boiler fuel oil, gas turbine fuel oil, and spilled oils from the transportation, storage, refining, and processing of petroleum products."

[from Chemical Abstracts 87(20):#154368j. 1977]

C-0441-78

A DESIGN PROCEDURE FOR PRACTICAL SUBDIVISION OF TANKERS SATISFYING IMCO REGULATIONS
Lorentz, J. D., and D. Kavlie. 1976.
North-Holland Publishing Company, 1976. 9p.

Tankers, Design-engineering, Ballast, IMCO, Regulations, *Computer methods

A computer method developed at the University of Trondheim for quickly modifying a proposed tanker topology into a feasible solution, where possible, and for improving it is described. Tanker-design has become more complex with the IMCO anti-pollution regulations contained in the 1973 Convention, and this method can aid in development of the cargo/ballast region. Some numerical examples applied to the layout of a segregated-ballast tanker of about 500,000 dwt are included.

[from Maritime Research Information Service Abstracts Vol. 15: #20 148464. 1977]

C-0442-78

TESTIMONY BEFORE THE SENATE COMMERCE COMMITTEE AND THE NATIONAL OCEAN POLICY STUDY ON RECENT TANKER ACCIDENTS
Tanker Advisory Center. 1977.
New York, Tanker Advisory Center, 1977. 6p.

Tankers, Pollution prevention, Design-engineering, Safety, Surveillance, US

Losses of oil tankers worldwide are analyzed and the loss ratios of 15 nations from 1964 to 1977 are tabulated. A program to improve the performance of all tankers over 10,000 dwt operating in US-controlled waters includes the following recommendations: provide casualty records to charterers and authorities; require tanker officers to take simulated piloting tests; retrofit segregated ballast tanks (SBT) on existing tankers; prohibit putting water in cargo tanks; and fit double hulls on new tankers.

[from Maritime Research Information Service Abstracts Vol. 15: #14 149575. 1977]

C-0443-78

CORROSION AND POLLUTION [in Danish]
Yding, F. 1976.
Dansk Kemi 57(6-7):147-148.

Oil tanks, Storage, Contamination, *Corrosion

"A review is presented on the corrosion of underground steel tanks which often results in oil contamination."

[from Chemical Abstracts 87(10):#71492u. 1977]

5. WASTE TREATMENT AND DISPOSAL METHODS

C-0444-78
NEW THERMAL PROCESS FOR PURIFYING WASTE WATERS
Anon. 1975.
Industial Heating 42(7):32-34.

Wastewater treatment, Waste oils, Reuse, Recycling, *Thermal process

Alcoa Aluminum Company has developed a process, using waste heat, conventional materials, and well established technology to purify a wide variety of oily wastewaters. The process yields reusable oil, concentrated solid wastes, and deionized recyclable process waters, and is suitable for a zero discharge system.

[from Selected Water Resources Abstracts 9(1):#W76-00214. 1976]

C-0445-78
WASTE OIL DISPOSAL AND RECYCLING ASSESSMENT
Anon. 1977.
Environmental Science and Technology (16):2.

Waste oil, Reclamation, Recycling, Disposal, Economics, EPA, Environmental effects

The US Environmental Protection Agency is funding research related to waste oil disposal and recycling. Among the contract outputs will be an assessment of the environmental impact of current waste oil utilization and disposal practices, an analysis of the energy and resource impact of virgin oil vs. recycled oil utilization, and an assessment of current technology and economics of waste oil reclamation and reuse.

C-0446-78
APPARATUS AND METHOD FOR WASTE WATER PURIFICATION BY ELECTROFLOTATION
Alfenaar, M. 1977.
German Offenlegungsschriften (unexamined patent application) 2,635,517

Emulsions, Wastewater treatment, Flotation, Coalescence, *Electrolysis

Wastewaters containing oil emulsions are passed upward through perforated electrodes, so that electrolytically formed gas bubbles attach themselves to suspended oil droplets and float the droplets to the surface where they coalesce into an easily removed foam.

[from Chemical Abstracts 87(12):#90363w. 1977]

C-0447-78
TREATMENT OF INDUSTRIAL EFFLUENTS
Callely, A. G., C. F. Forster, and D. A. Stafford (eds.). 1977.
London, Hodder and Stoughton, Ltd., 1977. xiii & 378p.

Wastewater treatment, Waste oil treatment, Oil spills, Petrochemicals, Biodegradation, Microorganisms, Industries

This book surveys the general principles of industrial wastewater treatment, emphasizing new developments in microbiological wastewater purification processes. Various industries are considered separately and a chapter is included on the petrochemicals industry, the treatment of industrial waste oils and oily wastewaters, and the natural fate and treatment of oil spills in the marine environment.

C-0448-78
SHORE FACILITIES FOR RECEPTION AND TREATMENT OF CARGO RESIDUES DIRTY BALLAST WATER FROM OIL AND/OR CHEMICAL TANKERS, OF OILY BILGE WATERS FROM ALL SHIPS, AS WELL AS FOR GAS FREEING OF TANKERS [sic]
Conti, C., and E. Biancuni. 1975.
Registro Italiano Navale Technical Bulletin No. 57, Nov. 1975. 83p.

Wastewater treatment, Ballast, Bilges, Tankers, *Shore facilities

The authors recommend the installation of shore facilities and assess the parameters for the design involved. Unit operations performed are discussed and a model is described.

[from Maritime Research Information Service Abstracts Vol. 15: #14 149293. 1977]

C-0449-78
THE PETROCHEMICALS AND RESINS INDUSTRY
Cox, A. P. 1977.
Treatment of Industrial Effluents. A. G. Callely, C. F. Forster, and D. A. Stafford (eds.). London, Hodder and Stoughton, Ltd., 1977. p. 218-228.

Petrochemicals, Industries, Wastewater treatment, Biodegradation, Adsorption, Oxidation, *Activated carbon

The petrochemicals industry's use of water and treatment of process waters is reviewed, with emphasis on biooxidation methods and the use of activated carbon adsorption.

C-0450-78
TREATMENT OF WASTEWATER CONTAINING OILS
Fukumori, R. 1976.
Japanese Patent 76 44,504

Wastewater treatment, Emulsions, Oil-water separation, Patent

To separate emulsified oil from wastewaters, a copolymeride product of a CO_2H-containing monomer and one from an ester of $C\geq4$ aliphatic alcohol-acrylic acid or methacrylic acid, or a fatty acid vinyl derivative are added.

[from Chemical Abstracts 87(10):#72975r. 1977]

C-0451-78
FACILITIES IMPROVEMENT FOR BIOCHEMICAL TREATMENT OF PETROLEUM REFINERY WASTEWATER
Gerber, V. Ya. 1976.
Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, Moscow, USSR, 1976. Washington, DC, US Environmental Protection Agency, 1976. p. 30-31.

Refineries, Wastewater treatment, Oxidation, *Biochemical treatment

"The use of combined facilities with high sludge doses and technical O instead of air intensified the biochemical treatment process for petroleum refining wastewater."

[from Chemical Abstracts 87(10):#72873f. 1977]

C-0452-78
TREATMENT OF SURFACTANT-CONTAINING WASTEWATER
Hara, M. 1977.
Japanese Kokai (unexamined patent application) 77 09,968

Wastewater treatment, Emulsions, Surfactants, Patent

"An NH_4, alkali metal, or alkaline earth metal salt of tannin-HCHO condensate and an inorganic coagulant are added to a surfactant-containing wastewater to remove surfactants and emulsified oils."

[from Chemical Abstracts 87(10):#72984t. 1977]

C-0453-78
BILGE WATER TREATMENT WITH A TUBULAR ULTRA-FILTRATION SYSTEM
Harris, L. R., D. F. Jackson, and P. Schatzberg. 1976.
David Taylor Naval Ship R & D Center, (SSL59) R & D Report DTNSRDC-76-0056. 36p.

Ultrafiltration, Wastewater treatment, Bilges, Fuel oil, Lubricating oil

A tubular ultrafiltration system using cellulosic and noncellulosic membranes was tested with a fuel oil, a lubricating oil, and bilge oil obtained from a YP (Patrol Craft). Both types produced good permeate quality, determined to be consistently less than 15 mg of oil/L. Both membranes, upon exposure to the YP bilge water, showed an irreversible flux decline; however, a modification in the cleaning procedure completely restored flux in the noncellulosic membrane.

[from Maritime Research Information Service Abstracts Vol. 15: #14 146059. 1977]

C-0454-78
ENZYME TECHNOLOGY FOR SHIPBOARD WASTE MANAGEMENT
Harris, L. R., and A. E. Lardis. 1976.
David Taylor Naval Ship R & D Center, (F57572), R & D Report No. DTNSRDC - 76-0117. 32p.

Ships, Pollution control, Monitoring, Analytical techniques, *Enzyme technology

Oil pollution control and analytical/monitoring systems are two of the areas identified for application of enzyme technology. Discussion includes recommendations for future research.

[from Maritime Research Information Service Abstracts Vol. 15: #14 151688. 1977]

C-0455-78
TREATMENT OF INDUSTRIAL WASTE OILS
Hill, E. C. 1977.
Treatment of Industrial Effluents. A. G. Callely, C. F. Forster, and D. A. Stafford (eds.). London, Hodder and Stoughton, Ltd., 1977. p. 336-345.

Waste oil treatment, Disposal, Industries, Wastewater treatment, Biodegradation, Reclamation

Separately discussed are the industrial waste oils that are reclaimable for reuse, and the oily industrial process waters from which oils are chemically or mechanically separated and subsequently disposed of by biodegradation.

C-0456-78
TREATMENT OF OIL EMULSION-CONTAINING WASTEWATER
Ikeda, S., Y. Fujimoto, T. Sato, and M. Yamazaki. 1977.
Japanese Kokai (unexamined patent application) 77 22,363

Wastewater treatment, Emulsions, Precipitation, Absorption, Patent

A water-soluble aluminum salt is added to oily wastewater and the pH is adjusted to 5-6.5, in order to absorb the oil on $Al(OH_3)$ and to form a removable precipitate.

[from Chemical Abstracts 87(12):#90365w. 1977]

C-0457-78

SEPARATOR FOR LIGHT LIQUIDS, ESPECIALLY FOR USE IN WASTE WATER PURIFICATION

Johne, G., and F. W. Roessner. 1976.
East German Patent 123,304

Wastewater treatment, Oil-water separation, Patent

A wastewater treatment tank is described which contains an oil-water separation section. The section has an inclined floor and a weir over which the oil flows to a collection point. Water passes out of the unit through pipes adjusted to remain below the oil collection level.

[from Chemical Abstracts 87(12):#90397h. 1977]

C-0458-78

SOLVING PETROLEUM REFINERY WASTEWATER PROBLEMS

Lindsay, J. T., and B. V. Prather. 1977.
Journal Waste Pollution Control Federation 49(8):1779-1785.

Wastewater treatment, Refineries, Design-engineering

Each refinery has its own unique set of wastewater treatment problems and requires a custom-designed treatment system. Data acquisition surveys are described which produce the data necessary for problem definition as well as problem evaluation. A case history of a petroleum refinery is presented wherein the approach was used to design and fabricate a wastewater treatment system.

C-0459-78

USE OF POLYURETHANE FOAM FOR PURIFYING OIL-CONTAINING WASTE WATERS [in Russian]

Lozovskii, D. S., Yu. A. Khailovich, V. I. Kikhteva, and S.K. Sevryukov. 1977.
Vodosnabzhenie i Sanitarnaya Tekhnika No. 4:28-30.

Wastewater treatment, Filtration, Oil-water separation, *Polyurethane foam

Oil-containing wastewaters were passed through a sand trap, settlement tank, and filter containing polyurethane packings, and oil was removed with 97-99% efficiency.

[from Chemical Abstracts 87(12):#90191m. 1977]

C-0460-78

REMOVAL OF EMULSIFIED OIL WITH ORGANIC COAGULANTS AND DISSOLVED AIR FLOTATION

Luthy, R. G., R. E. Selleck, and T. R. Galloway. 1978.
Journal Water Pollution Control Federation 50(2):331-346.

Wastewater treatment, Emulsions, Refineries, Flotation, Flocculation, Coagulation

Because the separation and removal of emulsified oil in refinery wastewaters by dissolved air flotation (DAF) is poorly understood, a laboratory and pilot plant study of the process was undertaken. Primary mechanisms of oil droplet-air bubble interaction, and the feasibility and cost-effectiveness of using organic surface-active agents and polyelectrolytes as coagulants in the DAF process were investigated. Results and recommendations are presented.

C-0461-78

REUSE OF CONDENSATE IN PETROCHEMICAL PLANTS

Mansfield, G. H. 1976.
Progress in Water Technology 8(2/3):55-63.

Wastewater treatment, Petrochemicals, Contamination, *Steam condensate reuse

Condensed steam recovery and reuse is an important economic and ecological issue in the petrochemicals field. Contamination and treatment of the condensate is discussed. Organic contamination (including hydrocarbons) represents the most difficult area for detection and effluent disposal.

C-0462-78

PROBLEMS OF WASTE-WATER PURIFICATION AT FUEL DEPOTS [English Summary]

Martin, A., and W. Hagemeier. 1977.
Technik und Umweltschutz No. 16:58-79.

Hydrocarbons, Soil, Groundwater, Wastewater treatment, Pollution control, *Fuel depots

"A review, with 57 references, of the presence of petroleum hydrocarbons in soil and groundwater and a method of decreasing the pollution."

[from Chemical Abstracts 87(22):#172247y. 1977]

C-0463-78

ACTIVATED SLUDGE DEGRADABILITY OF ORGANIC SUBSTANCES IN THE WASTE WATER OF THE KASHIMA PETROLEUM AND PETROCHEMICAL INDUSTRIAL COMPLEX IN JAPAN
Matsui, S., T. Murakami, T. Sasaki, Y. Hirose, and Y. Iguma. 1975.
Progress in Water Technology 7(3/4):645-659.

Wastewater treatment, Oil industry, Petrochemicals, Biodegradation, Activated sludge, Japan

Experiments to determine the biodegradability of 35 organic substances were carried out with activated sludge which was used daily in the operation of the joint wastewater treatment plant. Of the 35 organic substances, 14 were screened out as being strongly bioresistant. The discharge of these substances is not environmentally favorable, and suggestions for prevention of discharge are given.

C-0464-78

REMOVAL OF WATER IMMISCIBLE LIQUID FROM AQUEOUS PHASE
Matsumura, Y. 1976.
Japanese Kokai (unexamined patent application) 76,117,973

Waste oil treatment, Spill cleanup, Spill disposal, Adsorption, Patent, *Magnetic powder

Spilled oil and organic solvents can be removed from the water surface by means of adsorption onto a magnetic powder, such as steelmaking furnace dust, followed by magnetic collection of the powder and liquid mixture and disposal by pumping.

[from Chemical Abstracts 87(10):#72949k. 1977]

C-0465-78

WATER RESOURCES RESEARCH PROGRAM: TRANSPORT AND DISPERSION OF OIL-REFINERY WASTES IN THE COASTAL WATERS OF SOUTHWESTERN LAKE MICHIGAN (EXPERIMENTAL DESIGN: SINKING-PLUME CONDITION)
McCown, D. L., W. Harrison, and W. Orvosh. 1976.
Report ANL/WR-76-4. 51p.

Wastewaters, Disposal, Refineries, Spreading, Dispersion, Coasts, Great Lakes, Michigan

Field studies were conducted on the spreading and dispersion of chemically tagged, simulated refinery wastewaters. The dispersed phases were subsequently analyzed by neutron activation techniques. The methodology was judged to be successful in studying the transport and dispersion of simulated refinery wastes injected into coastal waters.

[from Chemical Abstracts 87(12):#90199v. 1977]

C-0466-78

PURIFICATION OF HYDROCARBONS-CONTAINING WASTE WATER WITH ACTIVATED CARBON IN THE PETROLEUM INDUSTRY. POSSIBLE APPLICATIONS OF THE METHOD IN OTHER BRANCHES OF THE INDUSTRY [in Swedish]
Nurminen, M. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 615-624.

Wastewater treatment, Oil industry, Adsorption, Equipment, *Activated carbon

A review of petroleum industry wastewater treatment is presented, comparing activated carbon adsorption to other methods. Advantages of activated-C treatment include a simple process and plant equipment, low sensitivity to rapid load variations, ease of starting and stopping the process, absence of toxicity symptoms, no formation of sludge, no need for auxiliary chemicals, and no odor problems.

[from Chemical Abstracts 87(10):#72784c. 1977]

C-0467-78

TREATMENT OF OIL-CONTAINING WASTE WATER
Ohtsubo, K. 1976.
Japanese Kokai (unexamined patent application) 76,138,057

Wastewater treatment, Oil-water separation, Precipitation, Patent

Oily wastewaters are treated with H_2SO_4 and $FeSO_4$ or a Fe^{2+} salt to pH 4-5 to separate an oil layer and an oil-containing water layer. $Ca(OH)_2$ is added to the oil-containing water to adjust pH to 10-12, followed by HCl, Al chloride, and finally an anionic polymer coagulant which precipitates oil and suspended matter.

[from Chemical Abstracts 87(10):#73085n. 1977]

C-0468-78

THE EFFECT OF ELEVATED TEMPERATURE ON THE AEROBIC MICROBIOLOGICAL TREATMENT OF A PETROLEUM REFINERY WASTEWATER
Phillips, W. E., Jr., and L. R. Brown. 1975.
Developments in Industrial Microbiology Vol. 16:296-304.

Wastewater treatment, Refineries, Microorganisms, *Temperature effects

Under aerobic conditions, microbiological treatment of oil refinery wastewaters was as efficient at 55° as at 30° in reducing organic components and total suspended solids. However, the removal of phenol, anthracene, naphthalene, toluene and phenanthrene differed in the 30° vs. 55° treatment.

[from Chemical Abstracts 87(12):#90209y. 1977]

C-0469-78
WASTE OIL AND REREFINED OIL
Piirila, E. 1977.
Kemia - Kemi 4(1/2):42-43.

Waste oil, Reclamation, Refining, Contamination, *Combustion

"A review with no references of the nature of waste oils, their degree of contamination as a function of the use conditions, Pb pollution by waste oil combustion, the H_2SO_4 earth process of oil recovery, and quality testing of rerefined oils."

[from Chemical Abstracts 87(10):#72776b. 1977]

C-0470-78
CRUDE WASHING
Powell, W. J. 1976.
Exxon International Incorporated, Maritime Administration.
Final report, EII. 12TMR.76, MA/RD-940-76056, June 1976.
Contract C-5-38000. 143p.

Oil discharges, Tankers, Pollution prevention, Ballast, Sludge, *Crude oil washing

"Crude washing is the process of washing the tanks of crude carriers during cargo discharge, using the cargo as the washing fluid. This report summarizes tests conducted to determine the effectiveness of crude washing. It concludes that crude washing is a viable technique for reducing operational pollution in normal ballast handling and sludge removal operations."

[from Maritime Research Information Service Abstracts Vol. 15: #19 143348. 1977]

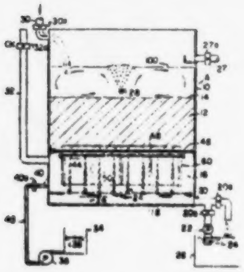
C-0471-78
REMOVAL OF GREASE AND OIL FROM PARTICULATE BED GRANULES BY BACKWASHING WITH A DETERGENT
Ross, D. S. 1976.
U.S. Patent 4,032,443

Wastewater treatment, Filtration, Surfactants, Patent

Oil and grease trapped in wastewater filter beds is removed by backwashing under pressure, using NaOCl and Na phosphate compounds as cleaning agents.

[from Chemical Abstracts 87(10):#73079p. 1977]

4,032,443
REMOVAL OF GREASE AND OIL FROM PARTICULATE BED GRANULES BY BACKWASHING WITH A DETERGENT
David S. Ross, Lorain, Ohio, assignor to Sterling Drug Inc., New York, N.Y.
Filed Jan. 29, 1976, Ser. No. 653,384
Int. Cl.² B01D *23/24*
U.S. Cl. 210—82 **19 Claims**



C-0472-78
SYMPOSIUM ON MANAGEMENT OF RESIDUES FROM SYNTHETIC FUELS PRODUCTION (1st)
Schmidt-Collerus, J. J., and F. S. Bonomo. 1976.
Report NSF/RA-770073, Contract NSF-AEN 75-00175. 359p. Held at Denver, Colorado, May 25-27, 1976.

Solid wastes, Disposal, Oil shale, Tar sands, Pollution control, Environmental effects, *Synfuels

Overview papers are presented on the technologies of gaseous, liquid, and solid waste residual materials that will be generated as a result of alternative fuels from oil shale, coal, tar sands, and in the use of the synfuels from these resources. Environmental effects including health hazards are discussed.

[from Government Reports Announcements 77(19):#PB-268 464/5GA. 1977]

C-0473-78
WATER RENOVATION AND REUSE
Shuval, H. I. 1977.
New York, Academic Press, 1977. 463p.

Industries, Refineries, Wastewater treatment

This book is divided into two main parts: Part I covers general and technological aspects of wastewater treatment technology as used by industries, municipalities and agriculture; Part II details experience and wastewater reuse in various countries. Wastewater treatment as pertains to oil-water separation, oil removal, and treatment methods used in the oil industry are mentioned throughout the text.

C-0474-78
TREATMENT OF DISCHARGED WATER FROM REFINERIES IN ROME [English summary]
Spadoni, S., and C. Massi. 1977.
Rivista della Societa Italiana di Scienza dell Alimentazione 6(2):109-120.

Wastewater treatment, Refineries, Sedimentation, Flotation

"A wastewater treatment system comprising an accumulation tank, grating station, sedimentation tank, air flotation tank, and 3 lagoons is used for treatment of petroleum refinery effluents."

[from Chemical Abstracts 87(12):#90276t. 1977]

C-0475-78
THE TREATMENT OF WASTEWATER FROM PETROLEUM BARGE CLEANING FACILITIES
Stryker, C. A., and J. E. Ball. 1975.
Annual Purdue Industrial Waste Conference, 30th, 1975 (Published 1977). Vol. 30:689-699.

Wastewater treatment, Design-engineering, Bilges, *Petroleum barges, *Cleaning facilities

A study of barge cleaning operations in the Houston-Port Arthur area of the Texas Gulf Coast was conducted to determine the treatability of the wastewater and to optimize treatment design. The waters are difficult to treat, partly because of the salinity of bilge waters and the variability in batch flow characteristics.

[from Chemical Abstracts 87(12):#90173g. 1977]

C-0476-78
MEASUREMENT AND TREATMENT OF OIL AND GREASE IN PETROLEUM AND PETROCHEMICAL INDUSTRIAL WASTEWATERS
Tischler, L. F., R. L. Elton, III, and D. L. Ford. 1977.
Progress in Water Technology 9(3):621-628.

Wastewater treatment, Chemical analysis, Oil-water separation, Oil industry, Petrochemicals, *Review

"It is the objective of this paper to summarize the sampling and analytical aspects of oil and grease determination, discuss oil removal processes and treatment technology, and document process effectiveness and limitations through a review of existing treatment systems. . . . It is shown that median effluent oil and grease concentrations below 10 mg/L are attainable with currently available technology, although peak concentrations of 50 to 60 mg/L can be expected due to inherent process variability."

C-0477-78
COMBUSTION TREATMENT USING EMULSIONS [in Japanese]
Tomihisa, K., and N. Kawai. 1976.
PPM 7(12):20-29.

Wastewaters, Waste oil, Emulsions, Fuels, *Combustion

"A technique is described for combustion of wastewater and oil by making an emulsion with the fuel."

[from Chemical Abstracts 87(12):#90149d. 1977]

C-0478-78
PROSPECT FOR THE THOROUGH PURIFICATION OF INDUSTRIAL WASTE WATERS FROM PETROLEUM REFINERIES IN AERATION PONDS [in Russian]
Zhurov, V. N., D. Abdukadyrov, A. A. Garanina, M. A. Denisov, and I. A. Kichigin. 1977.
Neftepererabatka i Neftekhimiya (Moscow): No. 5:14-16.

Refineries, Wastewater treatment, Oxidation, *Aeration ponds

"Artificial aeration and mixing of the waters intensified the O absorption, oxidation of residual organic matters, and purification of petroleum refinery effluents. Floating mechanical aerators of the disk type were recommended to feed air to 3-4 m depth and to accelerate the purification by 2.5-3 times."

[from Chemical Abstracts 87(10):#72898t. 1977]

6. OIL-WATER SEPARATION

C-0479-78
APPARATUS FOR PURIFICATION OF PETROLEUM-CONTAINING WASTE WATERS
Astvatsaturov, A. E., and I. G. Chaika. 1977.
USSR Patent 570,558

Oil-water separation, Wastewater treatment, Patent, *Centrifugal separation

"The apparatus contains a casing with a cone chamber for centifugal separation of petroleum-containing waters and an air feed collector installed in its lower part."

[from Chemical Abstracts 87(22):#172402v. 1977]

C-0480-78
EXPERIENCES IN THE PREPARATION AND CLEANING OF FUELS AND LUBRICATING OILS WITH CENTRIFUGES AND FILTERS
Bauer, W. 1976.
Schiff und Hafen Vol. 28. 10p.

Oil-water separation, Fuels, Lubricating oil, Bilges, Filtration, Ships

Shipboard cleaning, purifying, and clarifying of fuels and lubricating oils, and the various types, makes, and performance statistics of centrifuges and filters available for these operations are extensively reviewed. Several recommendations are made including some which concern oil-water separators for bilges, to conform to anti-pollution regulations.

[from Maritime Research Information Service Abstracts Vol. 15: #08 153044. 1977]

C-0481-78
REMOVAL OF OILS FROM WASTE WATERS
Belostotskii, M. D., and E. A. Chistyakova. 1977.
USSR Patent 567,678

Oil-water separation, Wastewater treatment, Patent, *Purification

"To increase the degree of purification, the effluents were treated with 2-4 g/L octadecylbenzyldimethylammonium chloride."

[from Chemical Abstracts 87(20):#156688n. 1977]

C-0482-78
STUDY OF SOLVENT REGENERATION DURING THE EXTRACTION OF PETROLEUM PRODUCTS FROM WASTE WATERS [in Russian]
Goncharenko, G. K., V. Ya. Shuteev, and V. P. Mikhailichenko. 1977.
Khimiya i Tekhnologiya Nekotorykh Spetsial'nykh Vidov Tsementa No. 4:40-42.

Oil-water separation, Solvents, Petroleum products, Extraction, Wastewaters, *Steam distillation

A description is given of a steam distillation process for the removal of petroleum products from waste water. The heat-transfer coefficients are also explained in detail.

[from Chemical Abstracts 87(24):#188819x. 1977]

C-0483-78
OIL ADSORBENTS
Hiyama, T. 1977.
Japanese Kokai (unexamined patent application) 77 46,666

Oil-water separation, Adsorption, Patent

"A porous sheet or ≥1 unwoven sheets lamination is immersed in a solution of rubber or elastic resin and water repellant, then immersed in a solution of an acid or an Al acid salt to produce an oil adsorbent."

[from Chemical Abstracts 87(12):#90378c. 1977]

C-0484-78
SEPARATION OF OIL IN WATER
Kawakami, K., Y. Moriyama, and T. Takuma. 1977.
Japanese Kokai (unexamined patent application) 77 80,292

Oil-water separation, Wastewaters, Adsorption, Patent, *Polyethylene

A column of powdered polyethylene or polyethylene foam is used to separate machine oil from water. A description of the sequence of events necessary to accomplish this is given.

[from Chemical Abstracts 87(22):#172397x. 1977]

C-0485-78
SEPARATION OF AROMATIC HYDROCARBONS AND INORGANIC CATALYST IMPURITIES FROM THE WASTE WATER OF PETROCHEMICAL SYNTHESIS PROCESSES
[English summary]
Kinder, R., B. Lindner, and F. Tampe. 1976.
Technik und Umweltschutz No. 13:48-60.

Oil-water separation, Aromatic hydrocarbons, Wastewater treatment, Petrochemicals, Filtration

A description of a method for the removal of hydrocarbons from a mixture of wastewater and ethylbenzene is given. The method utilizes an alkali precipitation and filtration process.

[from Chemical Abstracts 87(24):#188840x. 1977]

C-0486-78
OIL ADSORBENT
Nagakura, M. 1977.
Japanese Kokai (unexamined patent application) 77 60,284

Oil-water separation, Adsorption, Wastewaters, Patent, *Diatomite, *Zeolite

An oil adsorbent for removing oil from waste water, is made from porous materials, such as natural zeolite or diatomite. Methods for preparing the product are given. It adsorbs about 3-fold oil.

[from Chemical Abstracts 87(22):#172369q. 1977]

C-0487-78
FILTERS FOR OIL PARTICLES AND FINE SUSPENDED SOLIDS REMOVAL FROM WASTEWATERS
Nakanishi, T., J. Matsui, M. Aoki, and T. Ueda. 1977.
Japanese Kokai (unexamined patent application) 77 15,555

Oil-water separation, Bilges, Wastewaters, Filtration, Patent, *Polypropylene fiber

A description is given of a filtration system to separate oil or fine suspended solids from bilge or wastewater. The filtration material is polypropylene fiber felt cubes.

[from Chemical Abstracts 87(22):#172389w. 1977]

C-0488-78
APPARATUS FOR WASTE WATER PURIFICATION
Nielsen, H. 1977.
Norwegian Patent 136,294

Oil-water separation, Petroleum products, Wastewaters, Filtration, Equipment, Patent, *Separation tank

The device has a separation tank for oil, gasoline, etc., and a collection tank for the separated liquid. A description of the separation tank is given. The outlet tube has a filtration device within it.

[from Chemical Abstracts 87(22):#172375p. 1977]

C-0489-78
OIL ADSORBENTS
Ohshima, K., and T. Nakae. 1977.
Japanese Kokai (unexamined patent application) 77 42,485

Oil-water separation, Absorption, Adsorption, Patent, *Silicate, Sorbents

"A mixture containing 3-80 parts of alkali silicate of a molecular ratio SiO_2/Na_2O or SiO_2/K_2O 2-25 and 20-97 parts $(RSiO_{3/2})_n$, (R=Me, Et, Pr, vinyl, or Ph) is heated in the presence of water to obtain oil absorbents."

[from Chemical Abstracts 87(12):#90380x. 1977]

C-0490-78
WATER-TREATMENT AGENT IN SHEET FORM
Sato, H., and F. Oriya. 1977.
Japanese Kokai (unexamined patent application) 77 91,792

Oil-water separation, Adsorption, Patent, *Fiber sheet, *Turbine oil

"Fiber sheet is sprayed uniformly with slurry containing $\geq 1 Fe_2O_3$, $Fe(OH)_3$, and FeOOH and polymer emulsion and dried . . . When water containing 5000 ppm turbine oil was passed through the bed at 4 m/h, 2.5 g/g of the oil was adsorbed."

[from Chemical Abstracts 88(4):#27664y. 1978]

C-0491-78
SEPARATION OF FINE OIL DROPS FROM WASTE WATER
Shimizu, A., and S. Hirose. 1977.
Japanese Kokai (unexamined patent application) 76,131,476

Oil-water separation, Wastewaters, Filtration, Patent, *PVC membrane

A patent is described in which a membrane is made of poly(vinyl chloride) (PVC) and used to filter waste water from cutting oil. The oil content was reduced from 10,100 ppm to 100 ppm, with an oil drop diameter of 0.5 μ.

[from Chemical Abstracts 87(24):#188923b. 1977]

C-0492-78
APPARATUS FOR TREATMENT OF COMPRESSOR DRAINS [in Japanese]
Shinoda, K., and T. Hakamata. 1977.
Tokico Review 21(1):6-11.

Oil-water separation, Emulsions, Flocculation, Filtration, Incineration, *Compressor drains

An experimental apparatus for separating emulsified oils from water drained from compressors is described. "The apparatus consists of a floated oil separation tank, a reactor for floc formation with a flocculant, a filter for removing flocs, and an activated C-packed column." Sludge is incinerated. The system has a capacity of 400 L/day, and oil content can be decreased to <5 ppm.

[from Chemical Abstracts 87(20):#156542k. 1977]

C-0493-78
EFFECT OF SURFACTANTS ON THE KINETICS OF THE FLOTATION SEPARATION OF OILS EMULSIFIED IN WATER [in Russian]
Skrylev, L. D., R. E. Savina, and V. V. Sviridov. 1977.
Izvestiya Vysshikh Uchebnykh Zavedenii, Khimiya i Khimicheskaya Tekhnologiya 20(1):153.

Oil-water separation, Emulsions, Flotation, Surfactants

The flotation separation of oils emulsified in water was improved by addition of N-Alkylpyridinium salts. The nature of the oil (hydrocarbon chain lengths) and salt concentrations affect the efficiency of the separation.

[from Chemical Abstracts 87(10):#70510m. 1977]

C-0494-78
TESTING OF THE FEASIBILITY OF OIL REMOVAL FROM WATER SURFACE WITH OKITEN, EKOPERL 33, OR EKOPERL 66 [English summary]
Sljivaric, Z., I. Mijatovic, and V. Vukas-Delas. 1977.
Prehrambeno-Teknoloska Revija 15(1):22-24.

Oil-water separation, *Mineral oil, *Polyethylene scraps

Small scraps of polyethylene were used to remove mineral oil from a water surface. Several variables were studied and the results reported here. Particle size and amount have a greater effect on oil removal than does the length of time.

[from Chemical Abstracts 87(24):#188826x. 1977]

C-0495-78
REMOVAL OF OIL FROM WASTEWATER
Tanaka, K. 1977.
Japanese Kokai (unexamined patent application) 77 58,250

Oil-water separation, Wastewaters, Flocculation, Patent, *Thiolignin acid

A process whereby water mixed with oil is treated with thiolignin acid is described. Water containing 1000 ppm cutting oil was cleaned to 5 ppm using this process.

[from Chemical Abstracts 87(22):#172376q. 1977]

C-0496-78
OIL ABSORBENT
Tomita, S., Y. Matsuda, K. Terajima, and K. Abe. 1977.
Japanese Kokai (unexamined patent application) 77 75,682

Oil-water separation, Adsorption, Patent, *Fibers

Fibers from peat, coconut shell, and jute were impregnated with a paraffin emulsion, coated with a synthetic rubber latex, and thermally hardened to make an oil absorbent. Coconut shell fibers had an oil and water absorption of 2.9 and 1.8 g/g fibers respectively, vs. 2.6 and 3.6 for untreated fibers.

[from Chemical Abstracts 87(22):#172387u. 1977]

7 RECLAMATION AND REUSE

C-0497-78
CENTRIFUGAL PURIFICATION HELPS RECYCLE OILY WASTES
Anon. 1977.
Plant Engineering 31(2):66,70,74.

Waste oil, Reclamation, Fuel oil, Recycling, Wastewater treatment, *Centrifugation

Spent lubricating and other oils are recycled with a centrifugation system that separates them from plant waste streams. In a sample industrial installation, the facility has saved over $20,000 annually in fuel bills by recovering nearly 400,000 L of combustible oils, at the same time helping to meet environmental effluent standards.

C-0498-78
RECLAIMING SPENT MOTOR OIL
Ivey, H. D., Jr. 1977.
US Patent 4,029,569

Waste oil, Lubricating oil, Reclamation, Sludge, Patent

Waste lubricant oils are reclaimed by a process that includes heating to 700-720°F and H_2SO_4 treatment to precipitate solids, separating the sludge, and neutralizing the oil-soluble sulfonic acids with organic amines.

[from Chemical Abstracts 87(10):#70813n. 1977]

C-0499-78
HIGHLY VALUABLE LUBRICATING OIL COMPONENTS FROM USED OIL
Schulze, H., O. Pucher, W. Staude, B. Wenzel, et al. 1976.
East German Patent 121,337

Lubricating oils, Waste oil, Reclamation, Patent

Used lubricating oils are reclaimed by coarse cleaning, admixing 30-50% bitumen extracts from C_3H_8 - deasphalting of petroleum vacuum distillates, deasphalting with 3-10 parts C_3H_8 at 40-70°, and extracting with PhOH, cresol, furfural or other materials.

[from Chemical Abstracts 87(12):#87692v. 1977]

8. PERSONNEL TRAINING AND EDUCATION

C-0500-78
COAST GUARD PROPOSES REQUIREMENTS FOR PERSONS IN OIL TRANSFER OPERATIONS
Anon. 1977.
Environment Reporter 8(5):106-107.

Personnel training, Oil transfer, Regulations, USCG, Environmental protection, *Personnel qualifications

Because protection of the marine environment is one of the US Coast Guard's primary missions, the USCG is proposing a series of regulations providing qualifications for persons involved in, or in charge of, oil transfer operations. The proposed requirements and hearing dates are listed.

C-0501-78
OIL SPILL CLEANUP WORKSHOP HELD ON PRINCE EDWARD ISLAND (news brief)
Anon. 1978.
Sea Technology 19(1):40.

Personnel training, Canada, Spill cleanup, Coasts, *Onshore cleanup

A three-day seminar/workshop on Prince Edward Island was held on oil spill cleanup for Atlantic Canada. The program, designed to train commanders for response to a major coastal oil spill, emphasized onshore cleanup of different types of oil, and in different coastal environments.

C-0502-78
SPILL CONTROL COURSE GIVEN (news brief)
Anon. 1978.
Sea Technology 19(3):27.

Personnel training, Pollution control, Spill cleanup

The National Spill Control School, a program of Corpus Christi State University, offers a course in oil spill control for management personnel. For more information contact George Oberholtzer, Director, National Spill Control School, Corpus Christi State University, P.O. Box 8263, Corpus Christi, TX 74812.

C-0503-78
EMERGENCY RESPONSE PERSONNEL TRAINING PROGRAM
Duerden, F. C. 1977.
Spill Technology Newsletter 2(6):19-20.

Personnel training, Pollution prevention, Contingency planning, Oil spills, Inland, Canada, Information systems

The Environmental Emergency Division of the Canadian Environmental Protection Service has prepared an information program for firemen, policemen, and personnel from other agencies that are likely to be the first persons of authority at an inland petroleum products spill. The program is intended to "create an awareness of the environmental concerns in a hazardous material accident and to provide general and basic information so that the first person on scene can more adequately . . . address the problem with which he may be faced."

C-0504-78
SHORELINE PROTECTION, CLEANUP AND RESTORATION SEMINAR, PRINCE EDWARD ISLAND
Duerden, F. C. 1977.
Spill Technology Newsletter 2(6):28-30.

Personnel training, Spill cleanup, Restoration, Coasts, Beaches, Canada, *Prince Edward Island, *Seminar

A three-day seminar is summarized. The meeting was held in Toronto, Canada, in August 1977, by members of the Canadian Environmental Protection Service and the Petroleum Association for the Conservation of the Canadian Environment. The seminar was conducted primarily to familiarize on-scene-commanders and spill cleanup personnel with beach cleanup and spill removal techniques applicable to the Canadian coastline.

C-0505-78
SHIPBOARD GUIDE TO POLLUTION-FREE OPERATIONS
Maritime Administration. 1976.
Washington, D. C., Maritime Administration, 1976. 50p.

Personnel training, Pollution prevention, Ships, Tankers, Regulations

This guide aims to help the skilled tankerman be an effective pollution preventer. The chapters cover: 1) The Marine Environment; 2) The Threat to the Environment; 3) Pollution Regulations; 4) The Ship as a Pollution Fighter; 5) Pollution Free Operation; 6) Pollution Controls and Countermeasures; 7) Crew Training; 8) Shipboard Antipollution Committee; 9) Incentives and Awards; and 10) The Vessel Antipollution Library.

[from Maritime Research Information Service Abstracts Vol. 15: #10 138725. 1977]

C-0506-78
OIL SPILL CONTROL TRAINING: NATIONAL SPILL CONTROL SCHOOL
(news brief)
Oberholtzer, G. R. 1978.
Spill Technology Newsletter 3(1):24.

Personnel training, Pollution control, Spill cleanup, Contingency planning, *Oil spill control course

An oil spill control course offered by the Corpus Christi State University, Corpus Christi, Texas is briefly highlighted. The course features "state of the art" presentations from spill control industry personnel, and representatives from regulatory agencies, the Coast Guard, and EPA. The program is designed to provide a background for recognizing and initiating adequate contingency planning.

C-0507-78
OIL SPILL EXPERTS HELP ALASKANS GET READY
Parker, P. 1978.
National Fisherman 58(11):14-A.

Personnel training, Spill cleanup, Equipment, Compensation, EPA, NOAA, Alaska

An oil spill workshop sponsored by EPA and NOAA was held recently in Anchorage, Alaska. The meeting identified people and equipment available in different locations in the event of a major oil spill. Oil spill cleanup techniques were reviewed, and compensation questions were addressed.

C-0508-78
TANKER OPERATIONS COURSE: INSTRUCTOR'S NOTEBOOK
US Merchant Marine Academy. n.d.
Kings Point, NY, US Merchant Marine Academy. 175p.

Personnel training, Tankers, Oil transfer, Pollution prevention, Oil discharges, Safety, Regulations

"Provides a historical background of tanker operations, the characteristics and specifications of various petroleum products, loading calculations, tanker piping layouts, oil transfer procedures, loading and discharging, tank cleaning, safety precautions, pollution prevention methods and regulations, and deep water terminals and mooring techniques."

[from Maritime Research Information Service Abstracts Vol. 15: #10 138638. 1977]

C-0509-78
SKILLS NEEDED TO USE OIL CLEAN-UP SYSTEMS (product information)
[Vikoma International]. 1978.
Marine Pollution Bulletin 9(2):32.

Personnel training, Spill cleanup, Booms, Product information, Pollution control, *Vikoma Oceanpack

Vikoma Oceanpack, a new oil retention boom developed by Vikoma International, is designed for use in high sea conditions. The company stresses that the boom system, used in conjunction with oil recovery equipment, is only fully effective when used by efficient crews.

9. CONTINGENCY PLANNING

C-0510-78
CONTINGENCY PLANNING FOR THE IMPACT OF OIL SPILLS IN DIFFERENT COASTAL ENVIRONMENTS OF CANADA
Owens, E. H. 1977.
Report TR-243, Contract N00014-75-C-0192. 11p. Technical report.

Contingency planning, Oil spills, Spill cleanup, Coasts, Intertidal zone, Canada

Planning for an oil spill cleanup operation of the coastal zone requires consideration of the physical characteristics of the coast, wave energy levels, and tidal range. Three examples from very different coastal environments in eastern Canada are used to illustrate the importance of understanding the variability of littoral processes and of geological parameters in planning cleanup programs.

[from Government Reports Announcements 77(23):#AD-A043 713/7GA. 1977]

10. PREVENTION AND CONTROL MEASURES

C-0511-78
ANTI-POLLUTION VALVE AIDS SALVAGE
Anon. 1976.
Canadian Shipping and Marine Engineering, June. n.p.

Tankers, Design-engineering, Pollution prevention, *Anti-pollution valve

An anti-pollution valve (APV) for use on all liquid-cargo tankers, barges, and ship fuel-storage tanks has been developed. When a vessel is submerged due to a disaster, hydrostatic pressure closes the APV to stop the vent or overflow pipes from creating a spill; a pressure rupture is prevented by the automatic admission of seawater to equalize pressures outside and inside the tank. A quick-connection hookup permits salvage divers to attach a hose to pump liquids out and pump air in to assist in refloating the vessel.

[from Maritime Research Information Service Abstracts Vol. 15: #14 148837. 1977]

C-0512-78
CANADIAN PRODUCT PREVENTS SPILLS (product information)
Anon. 1976.
Transport Development News 1976:35-36.

Monitoring, Oil tanks, Pollution prevention, Equipment, Design-engineering, Product information, *Optic Liquid Level Sensor

Honeywell Ltd. of Toronto has developed the Optic Liquid Level Sensor (OLLS) to detect fluid levels in tank trucks or storage tanks during filling. Optical technology is used to automatically stop the filling operation when an overfill condition occurs. Specific safety features are described.

[from Maritime Research Information Service Abstracts Vol. 15: #14 142626. 1977]

C-0513-78
PREVENTION OF OIL SPILLAGES THROUGH CARGO PUMPROOM SEA VALVES
Anon. 1976.
Oil Companies International Marine Forum, 1976. 14p.

Pollution prevention, Tankers, Design-engineering

This report was written as a guide for use in policy decision-making in the management of oil tankers. Recommendations are made for adopting certain techniques or modifications for existing ships, as well as for new construction designs.

[from Maritime Research Information Service Abstracts Vol. 15: #14 149556. 1977]

C-0514-78
SAFETY PROGRAMME CUTS OIL POLLUTION IN U.S. PORTS (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(12):267-268.

Ports, Tankers, Pollution control, Monitoring, Safety, Personnel training, *Exxon

Exxon claims that a pollution control program instigated by them in 1968 has reduced oil spills by their ships. There were 18 incidents in 1971; this was reduced to 9 in 1976. The more than 40 Exxon pollution and safety control representatives monitor exchanges of cargo for spills and leaks.

C-0515-78
RECENT U.S. ACTIVITIES PERTINENT TO TECHNOLOGY FOR PREVENTING AND CONTROLLING OIL SPILLS AND BLOWOUTS IN ARCTIC REGIONS
Bates, C. C. 1977.
Spill Technology Newsletter 2(6):14-18.

Government agencies, US, Pollution prevention, Spill cleanup, Blowout prevention, Pipelines, Environmental protection, Arctic

Summarized are the roles and activities of the several US agencies that are involved in oil pollution and blowout prevention and control in the Arctic. The agencies discussed are the BLM, USDI, EPA, NOAA, USN, USCG, the Office of Pipeline Safety of the US Department of Transportation, and the Army Corps of Engineers Cold Regions Research and Engineering Laboratory, CRREL.

C-0516-78
WHAT TO DO WITH YOUR OIL POLLUTION (news brief)
Bourne, W. R. P. 1978.
Marine Pollution Bulletin 9(2):33.

Manuals, Spill cleanup, Wildlife, Mortality

"The British Nature Conservancy Council [has] produced an 'Oil Pollution Manual' for use by nature conservation and animal welfare organizations during oil or other pollution and animal mortality incidents." Information is available from the NCC Great Britain Headquarters, 19/20 Belgrave Square, London SWIX 8PY, England.

C-0517-78
SAFE COUPLING FOR TANKERS (product information)
[GEC Mechanics Handling Ltd.]. 1978.
Offshore 38(4):144.

Product information, Safety, Tankers, *GEC Mechanics Handling Ltd., *Coupling

GEC Mechanics Handling Ltd. introduced a self seal breakaway coupling for use by tankers. If a line pull exceeds an allowable load, the coupling halves separate and each end of the hose automatically seals, minimizing loss of oil and risk of pollution.

C-0518-78
CRUDE OIL WASHING OF TANKERS
Gore, S. S. 1977.
Catalyst for Environmental Quality 5(4):12-15.

Tankers, Oil tanks, Ballast, Crude oil, Pollution prevention, *Load-on-top, *Crude oil washing

A new technique is described for cleaning the cargo tanks of oil tankers. The method consists of using crude oil as a washing medium instead of seawater, and the method is applied in port during cargo unloading rather than at sea. The crude oil is applied via a high pressure jet and the technique effectively disperses even the most hardened oil residues. Coupled with the use of the load-on-top concept, crude oil washing on large tankers will eliminate most of the operational pollution.

C-0519-78
RESEARCH AND DEVELOPMENT PROGRAMS FOR POLLUTION CONTROL FROM OIL SHALE EXPLOITATION
Harris, E. F., and T. J. Powers. 1977.
Energy/Environment II - National Conference on the Interagency Research & Development Program, 2nd, Washington, D. C., 1977. p. 73-75. Report EPA-600/9-77-012 (EPA Decision Series).

Pollution control, Oil shale, Development, Extraction, Water quality, Solid wastes, EPA, *Research programs

Current EPA-sponsored or co-sponsored research programs related to pollution control in the oil shale industry are tabulated and briefly discussed. Groundwater and surface water pollution, air emissions, solid wastes utilization and disposal, and possible health effects of oil shale exploitation are the main areas of current research interest. Funding for many of the projects is shared with other agencies to avoid duplication and to ensure wider dissemination and application of research results.

C-0520-78
FIRE SERVICES AND THE ENVIRONMENT
Katz, W. B. 1977.
Spill Technology Newsletter 2(6):7-14.

Spill cleanup, Equipment, Inland, Petroleum products, Dispersants, Sorbents, Personnel training, *Fire-fighting

Several examples of inland petroleum product spills are reviewed, in which firefighters unwittingly created tremendous environmental cleanup problems in trying to deal with the spills. These case histories point out the need for specialized personnel training and better procedures and equipment for spill containment, cleanup and disposal. For the highly flammable petroleum products such as gasoline, imbibative polymer sorbent beads and dispersants are of special interest and their possible uses are discussed.

C-0521-78
OIL SPILL PREVENTION - AN INTERNATIONAL PERSPECTIVE
Kingham, J. D. 1978.
Spill Technology Newsletter 3(1):25-32.

Tankers, International agreements, Pollution prevention, Segregated ballast, *Crude oil washing

New and proposed international agreements which are designed to minimize operational and accidental pollution from oil tankers are discussed. Operational pollution can be curbed by installation or retrofitting of segregated ballast tanks, and the use of crude oil washing of tanks, rather than the traditional use of sea water in tank cleaning. Accidental spills will also be curbed by the use of backup radar and steering systems, alternate power systems, and collision avoidance aids.

C-0522-78
OIL POLLUTION IN THE MEDITERRANEAN SEA
Le Lourd, P. 1977.
Ambio 6(6):317-320.

Hydrocarbons, Mediterranean Sea, Tar, Tankers, Chronic effects, Sources, Pollution control

The Mediterranean Sea is becoming increasingly polluted with hydrocarbons. This article discusses the sources of oil, including tanker operations, accidental spills and other less frequent discharges and chronic pollution. Recommendations for prevention and pollution control are given.

C-0523-78
DOING SOMETHING ABOUT OIL SPILLS
Quigg, P. W. 1977.
Sierra Club Bulletin 62(7):21-24.

Oil spills, USCG, Tankers, Regulations, Personnel training, Standards, Pollution prevention, *Navigation aids

The article reviews regulations recently proposed by the Carter Administration designed to reduce tanker related oil spills in US waters, increase US Coast Guard inspection of foreign tankers, and improve oil tanker crew training. The development of more dependable radar-based navigation aids, the possible establishment of a 320 km-wide (200 mi) pollution zone coextensive with the present fisheries conservation zone, and the need for internationally accepted pollution standards are discussed.

C-0524-78
INDUSTRIAL POLLUTION CONTROL. VOLUME 1: EXECUTIVE SUMMARY
Ralph Stone and Co., Inc. 1977.
Report PB-270 178, Contract AID/ta-C-1091. 113p.

Pollution control, Industries, Environmental effects, Cost analysis

"A two-volume study was prepared to provide information relating to the impact and control of environmental pollution from industrial sources. . . . Volume I provides background information and reference sources to facilitate general policy decisions relating to the control of industrial pollutants. Volume II is concerned with the technical application and comparative costs of pollution abatement in manufacturing operations."

[from Government Reports Announcements 77(22):#PB-270 178/7GA. 1977]

C-0525-78
INDUSTRIAL POLLUTION CONTROL. VOLUME 2: TECHNOLOGICAL STRATEGIES
Ralph Stone and Co., Inc. 1977.
Report PB-270 179, Contract AID/ta-C-1091. 475p.

Pollution control, Industries, Cost analysis

This volume covers regional planning, methods and costs of industrial pollution control, case studies, and decision-making methods.

[from Government Reports Announcements 77(22):#PB-270 179/5GA. 1977]

C-0526-78
BLOW-OUT SAFETY INCREASED (product information)
[Reg O Co.]. 1978.
Offshore 38(3):117.

Product information, Safety, Blowout prevention, *M&M 2000T Series needle valve

Marketed by Reg O Co., the M&M 2000T series needle valve with a threaded and welded needle retainer is an added safety against blowouts. The valves can control oil as well as steam, water, or chemicals at either high or low pressure.

C-0527-78
SAFETY IN SHIPPING - A SEATRADE STUDY
Seatrade Publications Limited. 1976.
Essex, England, Seatrade Publications Ltd., 1976. 48p.

Ships, Pollution prevention, Spill cleanup, Oil transport, Ports, Cost analysis, Safety

A safety seminar was held in London during October 1976. Papers included the topics of the burden of pollution prevention measures, the cost of spill cleanup, and the increased burden on the ports to establish safer handling practices for dangerous cargoes.

[from Maritime Research Information Service Abstracts Vol. 15: #18 142616. 1977]

C-0528-78
UNITED TO PROTECT THE MEDITERRANEAN
Thacher, P. S. 1977.
Oceans 10(1):58-61.

Pollution prevention, UN, Mediterranean Sea, Environmental protection

The United Nations Environmental Protection Program, and its provisions for protecting the Mediterranean Sea area from pollution are briefly reviewed. Among the topics discussed are oil pollution, coastal water quality control and prevention of pollution from ships.

[from Aquatic Sciences and Fisheries Abstracts 7(9):#7Q10901. 1977]

C. ASPECTS OF OIL POLLUTION

1. BIOLOGICAL ASPECTS

C-0529-78
AFTERMATH OF AN OIL SPILL: A BLACK SEVEN YEARS
Anon. 1977.
Science News 112(6):84.

Oil spills, Fuel oil, Crustaceans, Marshes, Chronic effects, Toxicity, Massachusetts, *_Uca pugnax_

In 1969, a No. 2 fuel oil spill into Buzzards Bay, Massachusetts, heavily contaminated the adjacent Wild Harbor Marsh at West Falmouth. Results of a seven year study on the biological effects of the spill on the marshland fiddler crabs (_Uca pugnax_) are summarized. Although the spill was relatively small, it caused extensive and long-lasting physiological and behavioral damage to the animals. Populations have not recovered to pre-spill levels, and significant behavioral aberrations are common in the survivors.

C-0530-78
EFFECTS OF OIL ON BIRDS (news brief)
Anon. 1978.
California Agriculture 32(4):16.

Birds, Crude oil, Fuel oil, Biological effects, Reproduction, *Egg hatchability

Combined laboratory and field studies of the effects of oil pollution on avian reproduction are being conducted, using laboratory quail and wild auklets as subjects. The quail studies indicate that 200 mg Bunker C fuel oil depressed egg production and hatchability for 3 days, whereas Alaskan crude oil (800 mg) affected total egg production and shell quality but did not reduce egg hatchability.

C-0531-78
OXYGEN DEMAND OF MOLLUSKS WHEN PETROLEUM PRODUCTS ARE PRESENT IN DIFFERENT CONCENTRATIONS [in Russian]
Aliev, A. D. 1977.
Izvestiya Akademii Nauk Azerbaidzhanskoi Biologicheskikh Nauk
No. 2:60-64

Petroleum products, Mollusks, Uptake, *Oxygen demand

"Inhibition of O uptake by the mollusks, Mytilaster lineatus and Cerastoderma lamarcki, in the presence of petroleum products depended on the nature of the product, its concentrations, and the age of the mollusk." Uptake rates for the mollusks for different petroleum products are given.

[from Chemical Abstracts 87(23):#178596h. 1977]

C-0532-78

EFFECTS OF PETROLEUM HYDROCARBONS ON THE GROWTH OF MARINE ORGANISMS

Anderson, J. W. 1977.

Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:157-165.

Petroleum Hydrocarbons in the Marine Environment. A. D. McIntryre, and K. J. Whittle (eds.).

Marine organisms, Crude oil, Fuel oil, Metabolism, Reproduction, Growth

Marine organisms, ranging from phytoplankton to fish, were tested for various growth and reproduction responses to exposure to two crude oils and two fuel oils. Growth of oysters (Crassostrea virginica) and brown shrimp (Penaeus aztecus) was not affected by crude oil; but 3.5 mg/L of total dissolved hydrocarbons from No. 2 fuel oil reduced embroyonic heart beat and hatching successes of two fish species, and inhibited the growth of larval Paleomonetes pugio, juvenile Neanthes arenaceondentata, and three phytoplankton species.

C-0533-78

LABORATORY STUDIES ON THE EFFECTS OF OIL ON MARINE ORGANISMS: AN OVERVIEW

Anderson, J. W. 1975.

API Publication No. 4249. 70p.

Hydrocarbons, Marine organisms, Chemical analysis, Toxicity, Uptake, Release, WSF

This two-year research project analyzed test oil-water mixtures and animal tissues by use of GC/MS, and IR and UV spectrophotometry. The composition of oil-water-dispersions (OWD) and WSFs was studied. Bioassay tests with phytoplankton, crustaceans, and fish revealed that toxicities of both OWDs and WSFs from the refined oils were significantly greater than those from the crude oils. Physiological responses were studied and all species were shown to release acccumulated hydrocarbons when maintained in clear water.

C-0534-78

THE EFFECT OF CHEMICALS ON SOME MICROBIAL SELF-PURIFICATION PROCESSES IN BODIES OF WATER [English summary]
Bagdasar'yan, G. A., A. E. Nedachin, and T. V. Doskina. 1977.
Gigiena i Sanitariya Vol. 2:104-106.

Petroleum products, Surfactants, Microorganisms, Biological effects

The effects of chemicals (petroleum products, surfactants) in commercial and household wastes upon levels of certain viruses and bacteria were studied under natural conditions. Viruses were more resistant to the chemicals than *Escherichia coli* and *Bdellovibrio bacteriovorus*. Coliphage levels were virtually unaffected.

[from Biological Abstracts 65(1):#5222. 1978]

C-0535-78

EFFECT OF THE WATER-SOLUBLE FRACTIONS OF CRUDE, REFINED AND WASTE OILS ON THE EMBRYONIC AND LARVAL STAGES OF THE QUAHOG CLAM *MERCENARIA* SP.
Byrne, C. J., and J. A. Calder. 1976.
Report NSF/IDOE-77-119, Grant NSF-IDO 73-09745. 8p.

Toxicity, WSF, Crude oil, Fuel oil, Waste oil, Mollusks, Mortality, **Mercenaria*

The effects of the water-soluble fractions (WSFs) of 6 crude and fuel oils on the survival and growth rates of the quahog clam, *Mercenaria* sp., were investigated. Kuwait crude was the least toxic oil and waste crankcase oil was the most toxic, while Bunker C and No. 2 fuel oil had intermediate values. Surviving larvae exposed to the WSFs of the various oils grew at slower rates than the controls.

[from Government Reports Announcements 77(20):#PB-269 070/9GA. 1977]

C-0536-78

EFFECTS OF HYDROCARBONS ON THE FOOD INTAKE OF MUSSELS [in Danish]
Clemmesen, B. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 317-325.

Hydrocarbons, Fuels, Fuel oil, Biological effects, Mollusks, **Mytilus edulis*, *Food intake

"Physiological effects of pure aliphatic gasoline, benzene, and fuel oil in sublethal doses on *Mytilus edulis* were studied. Ecological effects were observed at doses below 0.25% benzene extract and below 40 ppm for hydrocarbon from fuel oil."

[from Chemical Abstracts 87(9):#63572e. 1977]

C-0537-78

THE EFFECTS OF OIL ON SEABIRDS

Croxall, J. P. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:191-195.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Birds, *Seabirds, Acute effects, Mortality, Behavior, Oil slicks, Dispersants

"The external effect of oil in destroying plumage waterproofing is detailed, and the state of knowledge of the direct and indirect internal effects of crude and fuel oils reviewed, inevitably in rather general terms. The need for more precise information on the behavior of oil slicks and oil/dispersant mixtures and films at sea is emphasized in relation to potential techniques and strategies for minimizing the high risk to seabirds from oil slicks."

C-0538-78

MICROBIOLOGICAL ASPECTS OF POLLUTION CONTROL

Dart, R. K., and R. J. Stretton. 1977.
Amsterdam and New York, Elsevier Scientific Publishing Co., 1977. viii & 216p.

Microorganisms, Pollution control, Health hazards, *Microbiological aspects

"This book deals with the applied microbiology of pollution and its control in connection with public health and hygiene. Each of the eleven chapters consists of a self-contained review of recent developments up until late 1976, including a large number of references to primary sources of information." A description of the microbiological problems associated with oil pollution is given in Chapter 10.

[from Elsevier Scientific Publishing Company brochure. 1977]

C-0539-78

SIZE-SELECTIVE MORTALITIES OF CLAMS IN AN OIL SPILL SITE

Dow, R. L. 1978.
Marine Pollution Bulletin 9(2):45-48.

Mollusks, Biological effects, Mortality, Oil spills, Maine, *Clams

Mixed No. 2 fuel oil and JP5 jet fuel were spilled into Long Cove, Searsport, Maine, in March 1971, and have concentrated locally to limits exceeding 250 ppm in intertidal sediments, at depths of 15-25 cm below the surface. Successive year class juvenile clams continued to die until 1976 as, in normal growth behavior, they burrowed down through redistributed overlying clean sediments into the oil concentration beneath.

C-0540-78
ENERGETICS OF PACIFIC HERRING (CLUPEA HARENGUS PALLASI) EMBRYOS AND LARVAE EXPOSED TO LOW CONCENTRATIONS OF BENZENE, A MONOAROMATIC COMPONENT OF CRUDE OIL
Eldridge, M. B., T. Echeverria, and J. A. Whipple. 1977.
American Fisheries Society, Transactions 106(5):452-461.

Crude oil, *Benzene, Fish, Metabolism, Growth, *Clupea harengus pallasi, *Embryos, *Larvae

Experiments were conducted to examine the metabolism of herring embryos, yolk-sac larvae, and post-yolk-sac larvae. Sublethal concentrations of benzene caused a significant decrease in embryonic tissue growth, differences in embryonic oxygen consumption, and significantly greater assimilation in feeding larvae.

C-0541-78
CHARACTERISTICS OF SOME BOTTOM ECOSYSTEMS IN THE OIL POLLUTED PART OF KOLA BAY AND NEAR ZHELANIYA CAPE (NOVAYA ZEMLYA) [English summary]
Golikov, A. N., and V. G. Averintsev. 1977.
Biologiya Morya (Vladivostok) Vol. 2:63-73.

Distribution, Metabolism, *Abundance, Benthos, Ecosystems, Arctic, USSR

The title areas were examined by scuba divers for the biological structure of macrobenthic populations, distribution, number of species, and the biomass and metabolic expenditures. Both polluted areas had an overall reduction in number of species as compared to unpolluted waters of similar depths.

[from Biological Abstracts 64(11):#61781. 1977]

C-0542-78
OIL TANKERS AND POLLUTION: A MICROBIOLOGICAL APPROACH
Gutnick, D. L., and E. Rosenberg. 1977.
Annual Review of Microbiology Vol. 31:379-396.

Crude oil, Hydrocarbons, Chemical analysis, Tankers, Microorganisms, Biodegradation

"A review [is presented] with 111 references, covering chemical composition of crude oil, physical interactions between microorganisms and hydrocarbons, petroleum biodegradation (nutritional requirements and metabolic specificity), and microbiological problems associated with oil tanker operations."

[from Chemical Abstracts 87(23):#180365a. 1977]

C-0543-78
SOME EFFECTS OF EMULSIFIERS AND OIL ON TWO COPEPOD SPECIES
Gyllenberg, G., and G. Lundqvist. 1976.
Acta Zoologica Fennica No. 148:1-24.

Emulsifiers, Sublethal effects, Mortality, Marine organisms, Crustaceans, *Copepods

The effects of different emulsifiers and oil on *Acartia bifilosa* and *Cyclops* (*Mesocyclops*) *oithonoides* were studied by examining the formation of large lipid droplets in the body tissue after death, the mean lethal dose and the response in terms of O_2 consumption. Toxicity tests indicated that the emulsifiers Finasol S.C., Finasol OSR-2, and various emulsifier-oil mixtures had different toxic effects. The sublethal responses, including escape movements, locomotor activity, and narcosis are described, and mortality rates are detailed.

[from Abstracts on Health Effects of Environmental Pollutants 6(9):#8916. 1977]

C-0544-78
ACCUMULATION OF ^{14}C-1-NAPHTHALENE BY AN OCEANIC AND AN ESTUARINE COPEPOD DURING LONG-TERM EXPOSURE TO LOW-LEVEL CONCENTRATIONS
Harris, R. P., V. Berdugo, S. C. M. O'Hara, and E. D. S. Corner. 1977.
Marine Biology 42(3):187-195.

Aromatic hydrocarbons, Uptake, Marine organisms, Zooplankton, *Copepods, *Radiolabeled naphthalenes

The oceanic copepod *Calanus helgolandicus* Claus and the estuarine species *Eurytemora affinis* Poppe were used in the title study. They were subjected to hydrocarbon concentrations ranging from 0.2 to 992 µg/l for up to 15 days, as a means of testing the effects on marine zooplankton of their persistent exposure to low levels of petroleum hydrocarbons. After initial uptake of hydrocarbons to species-specific amounts, accumulation leveled out after 7 to 8 days and remained at nearly constant levels until transfer to clean waters where rapid depuration of the radiolabeled naphthalene and its metabolites occurred.

C-0545-78
EFFECTS OF FOUR OILS ON MARINE BACTERIAL POPULATIONS: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Hodson, R. E., F. Azam, and R. F. Lee. 1976.
Report NSF/IDOE-77-104-14. 9p.

Crude oil, Fuel oil, Bacteria, Toxicity, Uptake, Metabolism, Canada

The effects of Louisiana and Kuwait crudes, No. 2 and Bunker C fuel oils were examined on heterotrophic uptake and mineralization of D-glucose-14C by microbial populations from Saanich Inlet, Canada. All oils inhibited uptake and mineralization, with the two processed oils being more toxic than the crude oils. Data indicate that concentrations of these oils in seawater above 300 µg/L can significantly inhibit bacterial activity.

[from Government Reports Announcements 77(22):#PB-270 146/4GA. 1977]

C-0546-78

XENOBIOTIC METABOLISM IN MARINE SPECIES EXPOSED TO HYDROCARBONS
James, M. O., and J. R. Bend. 1977.
Energy/Environment II - National Conference on the Interagency Research & Development Program, 2nd, Washington, D.C., 1977. p. 495-501. Report EPA-600/9-77-012. (EPA Decision Series)

Hydrocarbons, Toxicity, Metabolism, Marine organisms, Fish, Crustaceans, Mollusks, *Xenobiotic chemicals

This report is part of an ongoing study of the uptake, metabolism, distribution, and excretion of foreign chemicals (xenobiotics) in diverse marine species, including teleost and elasmobranch fishes, crustaceans, and mollusks. Present experimental results clearly show that exposure of certain fish to toxic metabolites of hydrocarbons has a biological effect long after the fish has been transferred to clean water. It also appears that aquatic species are more sensitive than mammals to both lethal and sublethal effects of a variety of xenobiotics. Fish, especially, may be useful model species for studying the teratogenicity, mutagenicity, or carcinogenicity of hydrocarbons and other chemicals.

C-0547-78

THE SUB-LETHAL EFFECTS OF WATER-SOLUBLE EXTRACTS OF CRUDE OIL ON THE FERTILISATION AND DEVELOPMENT OF *FUCUS SERRATUS* L.
Johnston, C. S. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:184-185.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

WSF, Crude oil, Sublethal effects, Algae, **Fucus serratus*, *Zygote development

"Many studies of oil pollution have shown that shore algae frequently flourish following elimination or severe reduction of the more sensitive grazing organisms. Preliminary studies suggest that although fucoid plants can tolerate exposure to spills of crude oil, the young developing zygote is sensitive to relatively low concentrations of 'water soluble' extracts of crude oils."

C-0548-78
OIL SPILL DISPERSANTS CAUSE BRADYCARDIA IN A MARINE FISH
Kiceniuk, J. W., W. R. Penrose, and W. R. Squires. 1978.
Marine Pollution Bulletin 9(2):42-45.

Fish, Sublethal effects, Dispersants, Surfactants, Biological effects

Oil dispersants caused bradycardia in fish similar to the effect of asphyxic hypoxia. The surfactant fraction of tested dispersants produced the reduced heart rate effect differing only in threshold concentrations. The effect could be debilitating to fish when added to natural stresses. As noted in hypoxia, bradycardia may impair fish swimming performance and increase fish susceptibility to predation.

C-0549-78
AN ASSESSMENT OF THE POTENTIAL CARCINOGENIC HAZARD OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT
King, P. J. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:202-211.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

PAH, Carcinogens, Health hazards, Food web, Contamination, Petroleum products

Polycyclic aromatic hydrocarbons (PAH) occur in crude oil and petroleum products, and are also present as byproducts of combustion, etc. "These substances have only a very limited solubility in water and at such low concentrations should cause little hazard, but there is a possibility of their concentration in the food chain. This paper attempts to examine all aspects of this problem in the light of published research in a variety of disciplines."

C-0550-78
SOOTS, TARS, AND OILS AS CAUSES OF OCCUPATIONAL CANCER
Kipling, M. D. 1976.
Chemical Carcinogens. C. E. Searle (ed.). Washington D.C., American Chemical Society, 1976. p. 315-323. (ACS Monograph 173.)

Carcinogens, Petroleum products, Health hazards, Aromatic hydrocarbons

In this chapter (Chapter 6) the pre-1975 British medical literature on the title topic is reviewed. Included is a brief discussion of the carcinogenicity of shale oil, petroleum oil, and petroleum derivative lubricating and cutting oils. Several known or potentially active aromatic hydrocarbons have been isolated in petroleum products.

C-0551-78
USE OF ALGAE IN SYNCHRONOUS CULTURE FOR TOXICITY TESTS
[in Norwegian]
Knutsen, G. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 327-328.

Dispersants, Biological effects, Algae, Toxicity, *Collectants

The effects of 3 oil treating agents upon the growth, mortality and survival of Chlamydomonas cells were analyzed. LD_{50} after 4.5 hours was only 1-3 ppm for Shell Oil Herder, 6-10 ppm for Nokimis III, and 270-500 ppm for Esso Butyl Jaysolve.

[from Chemical Abstracts 87(9):#63573f. 1977]

C-0552-78
OIL SPILLS IN CALIFORNIA AND EFFECTS OF CLEANUP AGENTS
Kopperdahl, F., C. Hazel, and N. Morgan. 1975.
California, State Water Resources Control Board Publication No. 56. 106p.

Spill cleanup, Biological effects, Fish, Uptake, Release, Biodegradation, Dispersants, California

Of the approximately 500 oil spills annually in California's coastal waters, about 10% are of more than 10 bbl oil, and about 53% are in the less than 1 bbl range. Most spills are due to human error during refueling, fuel transfer or bilge pumping. Fish are tainted at oil concentrations of 5 mg/L after 5 days, but 1 mg/L oil is sufficient in tainting fish after long term exposure. Dispersants increase the rate of petroleum accumulation, and relatively long periods are required for depuration. Petroleum degradation on beaches is slow and occurs only at the oil-water interface.

[from Chemical Abstracts 87(10):#73142d. 1977]

C-0553-78
THE EFFECT OF MINERAL OILS ON THE DEVELOPMENT OF EGGS AND LARVAE OF MARINE SPECIES. A REVIEW AND COMPARISON OF EXPERIMENTAL DATA IN REGARD TO POSSIBLE DAMAGE AT SEA
Kühnhold, W. W. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:175-183.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Marine organisms, Toxicity, Metabolism, Sublethal effects, *Egg and larval stages

A review of the pre-1975 literature on the title topic indicates that very few field observations on the effects of oil spills on eggs and larvae have been made; most of the research dealt with changes in ecosystems or with adult stages in animal life cycles. This author summarizes, tabulates, and compares existing data and states that it is "impossible to draw a general conclusion or see a connecting pattern of influence of hydrocarbons."

C-0554-78

ACCUMULATION OF AROMATIC HYDROCARBONS IN TISSUES OF PETROLEUM-EXPOSED MALLARD DUCKS (ANAS PLATYRHYNCHOS)
Lawler, G. C., W.-A. Loong, and J. L. Laseter. 1978.
Environmental Science & Technology 12(1):51-54.

Crude oil, Aromatic hydrocarbons, Uptake, Chromatography, Spectrometry, Birds, *Anas platyrhynchos

Mallard drakes were given a 5 ml/day dose of crude oil for 14 days. Tissues were examined for aromatic petroleum hydrocarbons using GC/MS methods. The skin accumulated far more hydrocarbons than liver, breast muscle, heart muscle, brain, uropygial gland or blood. The aromatic hydrocarbons did not accumulate in the same relative concentrations as found in the crude oil.

C-0555-78

ACCUMULATION OF SATURATED HYDROCARBONS IN TISSUES OF PETROLEUM-EXPOSED MALLARD DUCKS (ANAS PLATYRHYNCHOS)
Lawler, G. C., W.-A. Loong, and J. L. Laseter. 1978.
Environmental Science & Technology 12(1):47-51.

Crude oil, Hydrocarbons, Chromatography, Spectrometry, Birds, *Anas platyrhynchos

Tissues from Mallard drakes, which had been dosed with 5 ml/day of crude oil for 14 days, were examined for petroleum hydrocarbons using GC/MS methods. Oil was found in all tissue but the brain. The skin contained the highest level of hydrocarbons, followed in order by the uropygial gland, breast muscle, heart muscle, liver, and brain.

C-0556-78

THE EFFECTS OF THE WATER SOLUBLE FRACTIONS OF NO. 2 FUEL OIL ON THE SURVIVAL AND BEHAVIOR OF COASTAL AND OCEANIC ZOOPLANKTON
Lee, W. Y., and J. A. C. Nicol. 1977.
Report NSF/IDOE-77-120, Grant NSF-GX-37345. 15p.

Toxicity, WSF, Fuel oil, Zooplankton, Acute effects, Mortality

Acute effects of water-soluble fractions (WSFs) of No. 2 fuel oil on both coastal and oceanic zooplankton were studied and their LC_{50} for various exposure times (1 to 72 hr) were compared. Coastal zooplankton seemed to be more resistant than oceanic zooplankton, probably due to the dissimilar species composition of the two populations.

[from Government Reports Announcements 77(20):#PB-269 071/7GA. 1977]

C-0557-78

SURVIVAL OF TWO SPECIES OF AMPHIPODS IN AQUEOUS EXTRACTS OF PETROLEUM OILS

Lee, W. Y., M. F. Welch, and J. A. C. Nicol. 1977.
Report NSF/IDOE-77-114, Grant NSF-ID073-09740. 4p.

Toxicity, Crude oil, Fuel oil, Mortality, Crustaceans, WSF, *Amphipods

No. 2 fuel oil and Southern Louisiana crude were toxic at concentrations of 0.8 ppm and 2.4 ppm, respectively. Mortalities increased with the concentration and length of exposure. Few or no young were produced at these and higher concentrations. The two amphipods tested, *Gammarus mucronatus* and *Amphithoe valida*, are more sensitive to aqueous extracts of these oils than are benthic polychaetes and shrimp, for which data are available.

[from Government Reports Announcements 77(20):#PB-269 073/3GA. 1977]

C-0558-78

THE TOXICITY OF PURE HYDROCARBONS TO MUSSEL LARVAE

Le Roux, S. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:189-190.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

WSF, Hydrocarbons, Toxicity, Mollusks, Growth, *Mussel larvae

Laboratory work on the title topic is briefly reviewed. In the experiments, mussel larvae were subjected to WSFs of the petroleum hydrocarbons hexadecane, decalin, isopropylbenzene, n-decane, and cyclohexane. All but cyclohexane interfered with mussel growth; graphs are presented for the effects of each of the hydrocarbons.

C-0559-78

SUBLETHAL EFFECTS OF OIL ON MOLLUSC SPECIES FROM THE BALTIC SEA

Linden, O. 1977.
Water, Air, and Soil Pollution 8(3):305-313.

Crude oil, Mollusks, Sublethal effects, Behavior, Baltic Sea

Experiments are described which studied the effects of Iranian crude oil on mollusks from the Baltic Sea. Attachment, burrowing, and crawling rates were studied, and the effects of the oil on these activities are given.

[from Chemical Abstracts 88(3):#16893w. 1978]

C-0560-78
THE SEA URCHIN EGG AS A MODEL FOR TESTING OIL AND OIL DISPERSANTS
[in Norwegian]
Loenning-Vader, S. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 289-294.

Dispersants, Biological effects, Marine organisms, Echinoderms, *Sea urchin eggs, *Fertilization, *Bio-indicator

"Oil dispersants had a considerable inhibiting effect on the fertilization rate and on the percentage fertilization in sea urchins. Some typical effects of common dispersants on *Strongylocentrotus droebachiensis* were as follows (concentration in ppm, name of agent, % fertilization): 100, Corexit 7664, 39; 10, Corexit 9527, 25; 100, BP 1100X, 29; 10, BP 1100 WD, 88."

[from Chemical Abstracts 87(12):#90176k. 1977]

C-0561-78
THE SEA URCHIN AS A TEST OBJECT IN OIL POLLUTION STUDIES
Lönning, S. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:186-188.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Echinoderms, *Sea urchins, Toxicity, Dispersants, Petroleum products, *Bio-indicator

Laboratory studies are described which illustrate the use of sea urchin gametes and embryos as test materials for evaluating the toxicity of oil pollutants and oil dispersants.

C-0562-78
POLLUTION - EXTENSIVE REVIEW (book review)
Morris, R. J. 1978.
Marine Policy 2(1):76-77.

Biological effects, Marine organisms, Book review

A thorough review is presented of the book *Marine Pollution* [R. Johnston (ed.). London, Academic Press, 1976. xiv & 729p.]. The chapter on oil pollution (Colwell) is considered disappointing, because it does not mention much of the recent work on biochemical effects of oil pollution on marine organisms, and because the author concludes that the chief effects of oil pollution are aesthetic and transitory.

C-0563-78
THE EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON SOME OF THE ASPECTS OF CARBOHYDRATE METABOLISM IN FISHES AND INVERTEBRATES
Mazmanidi, N. D., and G. I. Kovaleva. 1975.
Journal of Ichthyology 15(5):811-816.

Petroleum products, Toxicity, Metabolism, Fish, Invertebrates, Acute effects, Chronic effects

The authors examine the symptoms of petroleum toxicosis in mobile aquatic organisms (fishes, their larvae and shrimps), and the alteration of indicators of carbohydrate metabolism in fishes, mussels, and shrimps under conditions of acute, subacute, and chronic toxicity by dissolved petroleum products. They conclude from the similarity of the reaction of these organisms at different phylogenetic levels that there may be a single mechanism in the action of dissolved petroleum products on living structures.

[from Oceanographic Abstracts and Bibliography 24(5):347. 1977]

C-0564-78
PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT
McIntyre, A. D., and K. J. Whittle (eds.). 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171. 230p. Proceedings from ICES Workshop in Aberdeen, 9-12 September 1975.

Hydrocarbons, Oceans, Fate, Biological effects, Chemical analysis, *Proceedings ICES Workshop

Thirty-six papers plus discussions are presented. The workshop dealt with research methodology and analytical techniques, the occurrence of petroleum hydrocarbons in the biota and physical environment, and their effects on marine ecosystems. Each paper is abstracted separately in this volume of Oil Pollution Reports.

C-0565-78
INGESTION OF CRUDE OIL: SUBLETHAL EFFECTS IN HERRING GULL CHICKS
Miller, D. S., D. B. Peakall, and W. B. Kinter. 1978.
Science 199(4326):315-317.

Sublethal effects, Birds, Crude oil, *Herring gull

"A single small oral dose of Kuwait or South Louisiana crude oil caused cessation of growth, osmoregulatory impairment, and hypertrophy of hepatic, adrenal, and nasal gland tissue in herring gull chicks living in a simulated marine environment. These findings suggest that ingesting crude oil causes multiple sublethal effects that might impair a bird's ability to survive at sea."

C-0566-78
EFFECTS OF PRUDHOE CRUDE OIL SPILLS ON COASTAL TUNDRA PONDS
Miller, M. C., J. R. Vestal, S. Mozley, M. Butler, and J. E. Hobie. 1977.
Energy/Environment II - National Conference on the Inter-agency Research & Development Program, 2nd, Washington, D. C., 1977. p. 521-529.

Crude oil, Oil spills, Freshwater, Biological effects, Plankton, Chronic effects, Arctic, *Insects, *Coastal tundra ponds

The biological effects of crude oil experimentally spilled into small coastal tundra ponds has been monitored for over 6 years. The spills have had long-lasting effects on phytoplankton and zooplankton survival and reproduction. Species composition and population in chironomids and other insects was strongly suppressed for several years. In some insects, this long term suppression is related to their multi-year larval stages.

C-0567-78
HYDROCARBON COMPOSITION OF THE BLACK SEA MUSSEL MYTILUS GALLOPROVINCIALIS [English summary]
Mironov, O. G., and T. L. Shchekaturina. 1977.
Zoologicheskii Zhurnal 56(8):1250-1252.

Hydrocarbons, Mollusks, Uptake, Black Sea, *Mytilus galloprovincialis, *Paraffins

The article discusses hydrocarbon content of the title mussel from two separate bays. The paraffin content differed significantly, giving rise to the idea of using mussels as indicators of oil pollution.

[from Chemical Abstracts 87(25):#195012g. 1977]

C-0568-78
ECOLOGICAL ASPECTS OF TOXICITY TESTING OF OILS AND DISPERSANTS (book review)
Morris, A. W. 1975.
The Journal of Applied Ecology 12(3):983.

Toxicity, Petroleum products, Dispersants, Analytical techniques, Book review, Europe

The title book [L. R. Beynon, and E. B. Cowell (eds.). London, Applied Science Publishers, for the Institute of Petroleum (Great Britain), 1974. vi & 149p.] presents the papers and discussions of a workshop given on the methods of such toxicity testing practiced by 10 laboratories in Ireland, Sweden, France, West Germany, and Britain. The reviewer criticizes the substandard subject index, and a summary article and unedited discussion which were not deemed of direct interest to the reader. However, the book is called "essential reading" as it points out the practical problems involved in such experimentation and the need for diverse physical, chemical, and biological knowledge application.

C-0569-78
TRANSFER OF PETROLEUM AND BIOGENIC HYDROCARBONS IN THE *SARGASSUM* COMMUNITY
Morris, B. F., J. Cadwallader, J. Geiselman, and J. N. Butler. 1976.
Marine Pollutant Transfer. H. L. Windom, and R. A. Duce (eds.). Lexington, Massachusetts, Lexington Books, D. C. Heath and Company, 1976. p. 235-260.

Hydrocarbons, Contamination, Food web, Sargasso Sea, *Transfer, *Biogenic hydrocarbons

Results of initial work concerning hydrocarbon transfer in the *Sargassum* community are presented. Associated fauna all showed high levels of petroleum contamination, but no correlation was found between natural and biogenic hydrocarbon content, and there does not appear to be consistent magnification along the food web. It is indicated that the overall petroleum load to the community is in response to long-term pollution, not to local tar accumulation.

C-0570-78
EFFECTS OF WATER POLLUTED BY OIL ON AQUATIC ANIMALS. IV. QUANTITATIVE DETERMINATION OF C_{14}-C_{24} N-PARAFFINS IN MARINE SCALLOPS, *PECTEN YESSOENSIS*
Motohiro, T., and Z. Iseya. 1976.
Hokkaido Daigaku Suisangakubu Kenkyu Iho 27(3-4):191-196.

Hydrocarbons, Chromatography, Sampling, Mollusks, Sediments, **Pecten yessoensis*

"The concentrations of n-paraffins (I) in unknown samples were determined by calculating the areas of the gas chromatograms and by referring to the standard curve. I from C_{14-24} were contained in the marine sediments which were collected from the scallop fishing ground and a similar chromatography pattern was obtained from the scallops."

[from Chemical Abstracts 88(1):#1177s. 1978]

C-0571-78
ECOLOGICAL ASPECTS OF TOXICITY TESTING OF OILS AND DISPERSANTS (book review)
Mount, D. I. 1975.
American Fisheries Society, Transactions 104(4):840-841.

Toxicity, Petroleum products, Dispersants, Analytical techniques, Europe, Book review

The title book [L. R. Beynon, and E. B. Cowell (eds.). New York, Halsted Press, John Wiley and Sons, 1974. viii & 149p.], here critically reviewed, contains the proceedings of a workshop entitled "Toxicity Testing of Oils and Dispersants." The reviewer states: "The book will be useful to anyone who wants to get a very cursory review of European activities related to the toxicity testing of oils and dispersants. It will not be of much use to others, because it does not give data or conclusions, and the methods are insufficiently described to be helpful."

C-0572-78
NATURAL VARIABILITY IN DISTRIBUTION OF AN INTERTIDAL POPULATION OF MACOMA BALTHICA SUBJECT TO POTENTIAL OIL POLLUTION AT PORT VALDEZ, ALASKA
Myren, R. T., and J. J. Pella. 1977.
Marine Biology 41(4):371-382.

Baseline studies, Oil terminals, Distribution, Mollusks, Intertidal zone, Chronic effects, Alaska, *Macoma balthica

The title study was conducted to obtain baseline information on natural variations in the population of the dominant tidal mudflat organism, the lamellibranch Macoma balthica. The study was conducted over the two year period, 1971-1972, in order to precede any low-level or chronic oil pollution which would arise from use of the port as an oil storage and tanker loading facility.

C-0573-78
CONTAMINATION BY ORGANIC SULFUR COMPOUNDS IN MARINE PRODUCTS
Nakamura, A., and T. Kashimoto. 1977.
Shokuhin Eiseigaku Zasshi 18(3):252-259.

Crude oil, Chromatography, Spectroscopy, Mollusks, Uptake, *Oysters, *Sulfur compounds

Compounds found in crude oil were used to indicate oil pollution in marine products. Sulfur compounds obtained from crude oil were analyzed by GC/MS. Similar analysis of fresh oyster tissue showed an accumulation of the same compounds.

[from Chemical Abstracts 87(21):#166130p. 1977]

C-0574-78
THE METULA OIL SPILL
National Oceanic and Atmospheric Administration. 1976.
Report NOAA-76112408. 342p.

Metula spill, Environmental effects, Crude oil, Marine organisms, Mortality, Baseline studies, Magellan/Strait of

The supertanker Metula spill in August 1974 of over 50,000 tons of crude oil into the Strait of Magellan is addressed. "Findings of a team of scientists from the United States and Chile, who investigated the environmental damage in August 1974 and again in January 1975, and of others who discussed the spill at a workshop, are summarized. Included are the background of the accident, the physical environment, the reasons why cleanup measures were not attempted, and the most important follow-up research needs."

[from Government Reports Announcements 77(21):#PB-270 418/7GA. 1977]

C-0575-78
ARCTIC MARINE ECOSYSTEMS AND OIL POLLUTION
Percy, J. A. 1975.
Circumpolar Conference on Northern Ecology. Ottawa, Ontario, National Research Council of Canada, 1975. p. II87-II98. Held September 15-18, 1975. Proceedings.

Crude oil, Marine organisms, Toxicity, Weathering, Ice, Ecosystems, Sediments, Arctic

The sensitivity of Arctic animals to spilled crude oil may be influenced by seasons, and seasonal parameters, such as temperature and ice-cover. Oil spilled under ice does not weather as fast as exposed oil, thus retaining its toxicity longer. Sediments contaminated by oil are toxic to certain benthic invertebrates.

[from Chemical Abstracts 87(21):#162358w. 1977]

C-0576-78
INVESTIGATION OF EFFECTS AND FATES OF POLLUTANTS
Pilson, M. E. Q., G. A. Vargo, P. Gearing, and J. N. Gearing. 1977.
Energy/Environment II - National Conference on the Inter-agency Research & Development Program, 2nd, Washington, D.C., 1977. p. 513-516. Report EPA-600/9-77-012. (EPA Decision Series)

Biological effects, Fate, Contamination, Plankton, Benthos, Models

An attempt to replicate the marine environment of the northeast US coast in the form of experimental microcosms is detailed. The microcosms are currently used to provide quantitative information on the fate and effects of low concentrations of oil contaminants on benthic animals, zooplankton and phytoplankton, and it is hoped that the microcosms will remain viable for at least one year.

C-0577-78

EFFECT OF NO. 2 FUEL OIL AND SOUTH LOUISIANA CRUDE OIL WATER-SOLUBLE FRACTIONS ON HEMOGLOBIN COMPENSATION AND HYPOXIA TOLERANCE IN THE POLYCHAETOUS ANNELID, NEANTHES ARENACEODENTATA (MOORE)
Rossi, S. S., and J. W. Anderson. 1977.
Marine Science Communications 3(2):117-131.

Crude oil, Fuel oil, WSF, Toxicity, Sublethal effects, Polychaetes, *Neanthes arenaceodentata

The ability of the title organism to increase its body hemoglobin content in response to hypoxia was not affected by sublethal concentrations of water-soluble fractions (WSF) of No. 2 fuel oil, but was slightly disrupted by WSFs of Louisiana crude. Reduced dissolved oxygen concentrations synergistically increased the toxicity of the WSFs of crude oil, but did not alter the toxicity of the fuel oil WSFs.

[from Chemical Abstracts 87(13):#96890k. 1977]

C-0578-78

EFFECTS OF OUTBOARD MARINE ENGINE EXHAUST ON THE AQUATIC ENVIRONMENT
Schenk, J. E., P. F. Atkins, Jr., R. L. Weitzel, P. B. Simon, *et al*. 1975.
Progress in Water Technology 7(3/4):733-741.

Hydrocarbons, Fuels, Biological effects, Lakes, *Outboard motor exhaust, *Bioassay

This 1970-1973 study was undertaken by EPA and the Boating Industry Association. A laboratory and a field study were conducted incorporating 'mini-lakes', leaded and non-leaded fuels, and bioassay experiments. No acute effects on the biota were observed.

C-0579-78

EFFECTS OF PETROLEUM ON BIRDS
Szaro, R. C. 1977.
Transactions of the North American Wildlife and Natural Resources Conference Vol. 42:374-381.

Crude oil, Birds, Chronic effects, Sublethal effects, *Ingestion, *Mallard ducks

A review of the effects of petroleum on birds is given. In addition, results of a study are presented, in which mallard ducklings were fed diets containing ≤50,000 ppm crude oil. They did not weigh as much as controls, but lived as long. Other details are discussed.

[from Chemical Abstracts 88(3):#16847j. 1978]

C-0580-78
CHARACTERISTICS OF SUSPENSIONS OF KUWAIT OIL AND COREXIT 7664 AND THEIR SHORT- AND LONG-TERM EFFECTS ON TISBE BULBISETOSA (COPEPODA: HARPACTICOIDA)
Venezia, L. D., and V. U. Fossato. 1977.
Marine Biology 42(3):233-238.

Crude oil, Dispersants, Emulsions, Acute effects, Chronic effects, Crustaceans, *Copepods, *Tisbe bulbisetosa

A technique for preparing seawater suspensions of crude oil and dispersant was developed, and the acute and chronic effects of the suspension on the title organism were determined. Although concentrations used were significantly higher than those in known polluted waters, adult females were found to be quite tolerant to the suspensions, and the long-term effects on egg production and larval hatching success were negligible when compared to the controls.

C-0581-78
EFFECT OF PETROLEUM ON THE LEVEL OF NORADRENALINE IN THE BRAIN TISSUE OF GOLDFISH AND MINNOWS [English summary]
Vosyliene, M. 1977.
Lietuvos TSR Mokslu. Akademijos Darbai Serija C(1):93-97.

Biological effects, Fish, Mortality, *Minnows, *Goldfish, *Noradrenaline levels, *Brain tissues

Goldfish (Carassius auratus) mortality rate changes were not apparent in the presence of 0.05 to 4 ml/L petroleum, whereas most minnows (Phoxinus phoxinus) died after two weeks of exposure to 4 ml/L petroleum. Minnow brain noradrenaline content was consistently increased by presence of petroleum, but for goldfish the results were inconsistent.

[from Chemical Abstracts 87(13):#96971n. 1977]

C-0582-78
FATE OF HYDROCARBONS IN FISH
Whittle, K. J., J. Murray, P. R. Mackie, R. Hardy, and J. Farmer. 1977.
Rapports et Procès-Verbaux des Reunions. International Council for the Exploration of the Sea. Vol. 171:139-142.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Hydrocarbons, Fish, Food web, Biological effects, Metabolism, Uptake, *Hexadecane, *Benzo[a]pyrene

"Juvenile herring were fed an experimental diet of squid containing [^{14}C]-labelled hexadecane and benzo[a]pyrene and the distribution of activity in various tissues and organs was assayed 43-45 hr later. 24-25% of the activity fed was recovered in the tissues and organs examined but the distribution of activity in these was quite different for each hydrocarbon. Most of the hexadecane recovered was found in the muscle but most of the benzo[a]pyrene remained in the stomach."

C-0583-78
PHENALEN-1-ONE: OCCURRENCE IN A FUEL OIL AND TOXICITY TO MICROALGAE
Winters, K., J. C. Batterton, and C. Van Baalen. 1976.
Report NSF/IDOE-77-113, Contract NSF-GX-37345. 4p.

Toxicity, Fuel oil, WSF, Algae, Growth, *Phenalen-1-one

Phenalen-1-one, isolated from the water-soluble fraction of a No. 2 fuel oil, had two different effects on the growth of microalgae. With blue-green algae toxicity occurred at 5 ppm and was independent of wavelength, whereas with green algae toxicity was wavelength dependent. In white light 250 ppb was lethal; with this same light screened by a yellow filter (530 nm), toxicity occurred at 10 ppm. Growth inhibition of a diatom was also wavelength dependent, but the required concentration was around twentyfold that for green algae.

[from Government Reports Announcements 77(20):#PB-269 076/6GA. 1977]

C-0584-78
WATER SOLUBLE EXTRACTIVES FROM PETROLEUM OILS: CHEMICAL CHARACTERIZATION AND EFFECTS ON MICROALGAE AND MARINE ANIMALS
Winters, K., C. Van Baalen, and J. A. C. Nicol. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:166-174.
Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Crude oil, Petroleum products, Biological effects, Mortality, Behavior, Algae, Microorganisms, Invertebrates

Four different fuel oils were tested against 6 strains of microalgae, including blue-greens, greens, and diatoms. The microalgae differed in sensitivity to each specific oil, and each alga differed in sensitivity to the various oils. The eggs, larvae or embryos of various invertebrates were also exposed to crude oils, fuel oils, and aromatic compounds to determine mortalities. Fuel oils and crankcase oils were especially toxic. Changes in behavior were noted.

C-0585-78
OIL POLLUTION ON THE POLISH COAST OF THE BALTIC SEA [English summary]
Wolk, K. 1975.
Ochrona Przyrody Vol. 40:229-246.

Biological effects, Birds, Mortality, Coasts, Baltic Sea, Poland, *Clangula hyemalis

"The oil menace on the Polish coast of the Baltic Sea which occurs from September-April and attains greater intensity from November-March is discussed in relation to its effect on the shorebirds of the area, particularly the long tailed duck (Clangula hyemalis). Data are given for the number of dead birds as a direct result of this environmental pollution."

[from Biological Abstracts 64(11):#65566. 1977]

C-0586-78
CRUDE OIL EFFECTS ON MICROSOMAL MIXED-FUNCTION OXIDASE SYSTEM COMPONENTS IN THE STRIPED MULLET (MUGIL CEPHALUS)
Yarbrough, J. D., and J. E. Chambers. 1977.

Crude oil, Fish, Toxicity, Acute effects, *Mugil cephalus

Juvenile striped mullet (Mugil cephalus) were exposed for 4 days to 2 different types of crude oil. It was found that the acute toxicity of Saudi Arabian crude was greater than that of Empire Mix crude oil.

[from Chemical Abstracts 88(3):#16921d. 1978]

2. PHYSICAL/CHEMICAL ASPECTS

C-0587-78
OIL POLLUTION AND MUSSEL CULTURE [in German]
Meixner, R. 1977.
Information für die Fischwirtschaft 24(3-4):99-101.

Contamination, Mollusks, Fisheries, Chromatography, Release, Metabolism, *Mussel cultures

Oil pollution is increasingly affecting European mussel cultures, primarily because of the undesirable taste of contaminated mussels. Gas chromatographic studies indicate that depuration of hydrocarbons from contaminated mussels (∿220 mg/kg) took 5 months. Self-purification is dependent on the metabolic activity of the animal and therefore also the ambient temperature.

[from Aquatic Sciences & Fisheries Abstracts 7(12):#7Q16560. 1977]

C-0588-78
KINETICS OF IN-SITU SELF-PURIFICATION IN MUSSELS CONTAMINATED BY A PETROLEUM HYDROCARBON [in French]
Michel, P. 1976.
Science et Peche No. 259:1-7.

Oil spills, Contamination, Fuel oil, Mollusks, Uptake, Release, France, *Port de Bouc spill, *Mussels

On Nov. 17, 1975, the tanker Port de Bouc spilled about 470 t of No. 2 fuel oil into Saint Brieuc Bight, polluting a commercial mussel field valued at $2 million within several days. The highest level of contamination was attained after 3 days (505 mg/kg of wet flesh, compared to 16 mg/kg for controls) and a petroleum taste was still discernible after 3 months. 5 months were necessary for a complete removal of contaminants. No mortality was observed and mussels had a normal growth rate during this period.

[from Aquatic Sciences & Fisheries Abstracts 7(11):#7Q14998. 1977]

C-0589-78
SOME DYNAMICS OF SPILLED OIL IN A FRACTURED ICE FIELD IN BUZZARDS BAY, MASSACHUSETTS
Welsh, J. P., I. M. Lissauer, G. L. Hufford, T. S. Ellis, et al. 1977.
Ocean Engineering 4(4/5):197-203.

Movement, Spreading, Ice, Oil spills, Fate, Behavior, Massachusetts, *Buzzards Bay

Four days after about 300 m^3 oil were accidentally spilled under ice, about 60% of the oil was incorporated into the fractured ice zones and onto the ice surface. Movement of oil into and onto the ice was basically a result of oil/water density differences and ice field deformation. Fracture zones formed conduits along which oil spread into and over the ice. When these leads closed, the oil was trapped as pools on the ice and was further spread by winds.

3. SOCIAL/ECONOMIC ASPECTS

C-0590-78
WHAT PRICE POLLUTION (news brief)
Anon. 1976.
BioScience 26(10):60.

Oil spills, Economic effects, Marine organisms, Compensation, California, *Monetary values

The state of California has decided to make polluters pay for the damage they cause, and has developed a price list assigning a monetary value to flora and fauna that are killed by pollution incidents such as oil spills. The lists, developed by the California Department of Fish and Game uses market values wherever possible, or takes into consideration the destroyed organism's replacement value, use value, and psychic or aesthetic value.

C-0591-78
ECONOMIC IMPACT OF PROPOSED AMENDMENT TO WATER POLLUTION REGULATIONS FOR HEXANE EXTRACTABLE MATERIALS, R74-1,8,9
Bates, L. W. 1977.
Report IIEQ-77-17. 199p. Final report.

Regulations, Pollution control, Oil discharges, Economic effects, Illinois, *Hexanes

This report examines the economic effects of amending Rule 408, Chapter III, of the "Rules and Regulations" of the Illinois Pollution Control Board (1976). The amendment would change the current 15 mg/L standard for total oil discharged from point sources.

[from Government Reports Announcements 77(20):#PB-269 184/8GA. 1977]

4. GENERAL ASPECTS

C-0592-78
POLLUTION FROM VESSELS: DIVERSE EQUIPMENT OFFERED TO MEET WATER QUALITY STANDARDS
Anon. 1976.
Marine Engineering/Log 81(6):27-37.

Regulations, Pollution control, Equipment, USCG, IMCO, Oil industry

"Highlights of the U.S. and IMCO oil pollution control and sewage regulations are presented, and USCG methods for identifying polluters are outlined. Exxon U.S.A. reports on its pollution control efforts. Lists of available oil-water separators, oil spill control equipment, and MSDs are also provided."

[from Maritime Research Information Service Abstracts Vol. 15: #14 142922. 1977]

C-0593-78
SYMPOSIUM WEIGHS EFFECTS OF OIL POLLUTION
Anon. 1976.
BioScience 26(10):601-604.

Environmental effects, Offshore production, Hydrocarbons, Marine organisms, Sublethal effects, Fate, Sources, *Symposium

Briefly summarized are the conclusions of some of the papers presented at the Symposium "Sources, Effects, and Sinks of Hydrocarbons in the Aquatic Environment," held August 9-11, 1976, at American University, Washington, D.C. The field studies reviewed tended to minimize the adverse effects of oil pollution; biological studies showed the sublethal effects of oil contamination, and studies of the fate of oil at sea emphasized the role of biodegradation.

C-0594-78
WORSE LUCK NEXT TIME FOR THE NORTH SEA?
Anon. 1977.
New Scientist 74(1058):760.

Blowouts, Pollution prevention, Regulations, Safety, Contingency planning, North Sea, UK

The apparent lack of adverse effects from the Ekofisk blowout in April 1977 was a result of fortuitous circumstances, and the incident has pointed out the need for effective national emergency response and coordinated research and development in combatting oil pollution. Since the incident the UK has enacted over a dozen sets of safety regulations and more are to come.

C-0595-78
ECOLOGICAL EFFECTS OF MARINE OIL POLLUTION
Baker, J., J. Addy, B. Dicks, S. Hainsworth, *et al*. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:196-201. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Ecosystems, Environmental effects, Coasts, Shorelines, UK, Marine organisms, Toxicity

Field surveys and experiments on the title effects to various nearshore biological communities are described. The work, conducted by the Field Studies Council Oil Pollution Research Unit, Pembroke, UK, includes studies of the rocky shoreline, salt marshes, sand and mud flats. The comparative toxicities, tolerances of various species and behavioral responses of animals are discussed.

C-0596-78
WATER POLLUTION TECHNOLOGY
Black, J. A. 1977.
Reston, VA., Reston Publishing Co., Inc., 1977. 260p.

Sources, Legislation, Contamination, Pollution control

This textbook is a synthesis of general information on marine, surface, and groundwater systems; the sources and consequences of pollution and possible solutions; as well as applications and the analytical methods commonly used in water and wastewater monitoring. Oil pollution is briefly discussed in the chapters on types and sources of contamination, and legal aspects of water pollution control.

C-0597-78
POLLUTION OF THE SEA BY HYDROCARBONS [in French]
Carronne, M. P. 1976.
Annales Hydrographiques, Series 5. 4(3):108p.

Sources, Environmental effects, Petroleum products, Crude oil, Detection, Chemical analysis, Monitoring, Bibliographies

This document presents a general review of the origins and general characteristics of crude oil and petroleum products, and the inputs and environmental effects of petroleum pollutants. The detection, identification, and monitoring of petroleum pollutants in the marine environment is also discussed. An extensive pre-1974 bibliography is included.

[from Underwater Information Bulletin 9(6):32. 1977]

C-0598-78
INPUTS, TRANSPORT MECHANISMS, AND OBSERVED CONCENTRATIONS OF PETROLEUM IN THE MARINE ENVIRONMENT
Clark, R. C., Jr., and W. D. MacLeod, Jr. 1977.
Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms. Vol. I. Nature and Fate of Petroleum. D. C. Malins (ed.). New York, Academic Press, Inc., 1977. p. 91-223.

Sources, Crude oil, Hydrocarbons, Fate, Physical effects, Chemical effects, Biological effects

A literature review of the title subjects is presented in Chapter 2. The chapter summarizes the known and potential inputs of petroleum from land-based and marine operations, natural seeps, and the atmosphere; the fate of oil, and the physical, chemical, and biological processes that affect oil spilled at sea; and petroleum hydrocarbon levels in marine organisms, sediments, and seawater. A list of 286 references is included.

C-0599-78
IMPACT OF OIL ON THE MARINE ENVIRONMENT
Food and Agriculture Organization. 1977.
Report of a Study by GESAMP, Vol. 6. 250p.

Petroleum products, Biodegradation, Carcinogens, Mortality, Sublethal effects, Uptake, Release

"A report on the impact of oil on marine environment, covering tainting, deoxygenation, effects of microbiological populations, carcinogens, lethal effects, sublethal effects, heating effects, routes into and within biosystems is given."

[from Chemical Abstracts 88(3):#16834c. 1978]

C-0600-78
HYDROCARBONS IN THE MARINE ENVIRONMENT
Garrett, W. D. 1975.
Background Papers for a Workshop on the Tropospheric Transport of Pollutants to the Ocean. Washington, D.C., National Academy of Sciences, 1975. p. 115-120.

Hydrocarbons, Petroleum products, Oil transport, Oceans, Sea surface, *Air-sea interface

It is hypothesized that the rate of hydrocarbon introduction into the atmosphere depends upon the type and volatility of petroleum products. Factors in handling and transportation enter into discussion, and fluxes at the air-sea interface are estimated as about 1.4 Tg/y for the Northern Hemisphere.

[from Chemical Abstracts 87(22):#172525n. 1977]

C-0601-78
HYDROCARBONS AND PETROLEUM IN THE MARINE ECOSYSTEM - A REVIEW
Hardy, R., P. R. Mackie, and K. J. Whittle. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:17-26. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Hydrocarbons, Sources, Sampling, Fate, Chemical analysis, Biological effects, *Review

This brief review with 140 references considers input, methodology, occurrence, fate, and effects of hydrocarbons in the marine environment. Sampling and analytical techniques appear complex, especially in the open sea. The fate of petroleum components is unknown, but the amounts present in the sea seem to exceed the estimated annual input by several orders of magnitude. The effects of petroleum vary with the composition, concentration, and the interacting component.

C-0602-78
ORGANIC ENVIRONMENTAL POLLUTANTS IN WATER - REVIEW OF CONDITIONS IN NORWAY [in Norwegian]
Hatling, J. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 15-22.

Contamination, Petroleum products, Sediments, Norway

"The review, with no references, covers bottom sediment concentrations in fjords as a function of downstream distance, measures taken to restrict contamination from industrial sources, and petroleum pollutants."

[from Chemical Abstracts 87(12):#90442u. 1977]

C-0603-78
COASTAL GEOMORPHOLOGY AND SEDIMENTATION OF THE METULA OIL SPILL SITE IN THE STRAIT OF MAGELLAN
Hayes, M. O., and E. R. Gundlach. 1975.
Report to Advanced Environmental Research & Technology, National Science Foundation. 103p.

Sediments, Magellan/Strait of, Metula spill, Coasts, Sedimentation, *Geomorphology

Summary not available.

[from Marine Pollution Bulletin 8(6):136. 1977]

C-0604-78
ENVIRONMENTAL POLLUTION
Hodges, L. 1977.
New York, N.Y., Holt, Rinehart and Winston, 1977. 496p.

Sources, Oil industry, Tankers, Natural seepage, Environmental effects, Water quality, Inland

In this general text on the nature, sources and effects of environmental pollutants, the sources and problems of marine and inland oil pollution are briefly reviewed in the chapter on industrial and commercial water pollution (Chapter 10).

C-0605-78
WHAT NORTH SEA OIL MIGHT COST FISHERIES
Johnston, R. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:212-223. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Fisheries, North Sea, Oil spills, Cost analysis, Economic effects, Offshore development

Published information is inadequate for an accurate assessment of the impact of oil development on North Sea fisheries; thus, the author marshals available data to make a tentative appraisal of the possible loss of fish resulting from spill scenarios of various magnitudes and probabilities. It is concluded that even a catastrophic spill would result in only a small loss to fish production or its approximate cash equivalent. Physical obstruction to fishing is seen as a possibly more serious interference.

C-0606-78
POLLUTION IN THE NORTHEAST PACIFIC OCEAN
Karrick, N. L., and E. H. Gruger, Jr. 1976.
Marine Fisheries Review 38(11):2-19.

Contaminants, Hydrocarbons, Biological effects, Fate, Fish, Pacific Ocean, Industries

The first part of this paper is a general review of the major classes of contaminants, their physical transport and distribution in the aquatic environment, and their acute and long-term toxic effects on marine life, primarily fish. Pollutants discharged into the Northeast Pacific by various industries, agriculture, and food processing are discussed. Petroleum hydrocarbons are mentioned throughout the article.

C-0607-78
WATER QUALITY IN TOKYO BAY [English summary]
Koido, Y., H. Kawahara, K. Soda, and H. Esumi. 1975.
Annual Report of Tokyo Metropolitan Research Institute of Environmental Protection, 1975:23-43.

Oil spills, Ships, Oil discharges, Ecosystems, Water quality, Japan, *Tokyo Bay

Data on the pollutants in Tokyo Bay are presented and effects of organic C and total P distribution are discussed. Pollution, including oil from ships, has completely destroyed the ecological cycle of the Bay.

[from Chemical Abstracts 87(20):#156735a. 1977]

C-0608-78
EFFECTS OF PETROLEUM ON ARCTIC AND SUBARCTIC MARINE ENVIRONMENTS AND ORGANISMS. VOL. 1. NATURE AND FATE OF PETROLEUM
Malins, D. C. (ed.). 1977.
New York, Academic Press, 1977. 321p.

Hydrocarbons, Petroleum products, Marine organisms, Arctic, Oceans, Subarctic regions, Fate, Sources

The two volumes of this work were compiled to present a cogent discussion of the title topics. In Volume I, Chapter 1 (Clark & Brown) deals with physical characteristics and chemical properties of petroleum, methods of hydrocarbon analysis, and the presence of hydrocarbons in petroleum and organisms. Chapter 2 (Clark & MacLeod) discusses potential petroleum hydrocarbon inputs, spill transport mechanisms, and hydrocarbon levels in the marine environment. Chapter 3 (Karrick) is entitled "Alterations in Petroleum Resulting from Physico-Chemical and Microbiological Factors." A total of nearly 700 references is provided. The chapters are summarized separately in this report.

C-0609-78
MARINE ENVIRONMENT IN THE RED SEA
Martin, T. 1977.
Journal of the Society for Underwater Technology 2(4):23-24.

Sources, Behavior, Fate, Oil slicks, Oil spills, Pollution control, Biological effects, Red Sea

A brief, general review is presented on the sources of oil pollution, the fate and behavior of oil spills and slicks, and research needed to measure, monitor, and control oil pollution in the Red Sea.

[Underwater Information Bulletin 9(3):#7706/1349. 1977]

C-0610-78
PETROLEUM, A POLLUTANT IN SEARCH OF TOXICITY? (letter to the editor)
Payne, J. F. 1978.
Marine Pollution Bulletin 9(2):108-113.

Hydrocarbons, Chronic effects, Marine organisms, Toxicity, *Toxicological research

A lack of evidence to indicate that oil is harmful to most marine environments and a lack of sophisticated tools for an ecological study, motivated the author to suggest that future research might focus on the effects of chronic hydrocarbon exposure on marine organisms. A toxicological approach at the physiological-biochemical level was recommended.

C-0611-78
GEOBIOLOGY, ECOLOGY, PLANNING. POLLUTION OF MARINE WATERS [in French]
Peres, J.-M. (ed.). 1976.
Paris, France, Gauthier Villars, 1976.

Hydrocarbons, Fate, Ecosystems, Environmental effects, Pollution control

A collection of papers on the chemical, physical, and biological pollution of the sea is presented. Topics covered include the control of hydrocarbon pollution, and the interaction of hydrocarbon with biocenoses.

[from Biological Abstracts 65(1):#1751. 1978]

C-0612-78
STUDY OF SEA WATER CONTAMINATION IN THE BURGAS DISTRICT
[English summary]
Royachki, M., T. Gurdanov, and A. Traikova. 1977.
Trudove po Vodosnabdyavane, Kanalizatsiya Sanitarna Tekhnike 12(2):43-50.

Contamination, Petroleum products, Seawater, Black Sea, *Bulgaria

Samples of seawater from the Burgas district of Bulgaria were examined for oil and other contaminants. The amount of oil varied from 0 to 54 g/m^3.

[from Chemical Abstracts 87(22):#172431d. 1977]

C-0613-78
RECENT NATURAL AND ANTHROPOGENIC VARIATIONS IN THE CHEMICAL COMPOSITION OF THE WATERS OF THE BALTIC SEA
Simonov, A. I., S. G. Oradovskii, S. K. Revina, and S. A. Patin, *et al*. 1976.
Ambio Special Report Vol. 4:11-15.

Contamination, Chronic effects, Chemical effects, Baltic Sea, *Oxygen deficiency

The chronic O_2 deficiency in the lower layer of the Baltic Sea over the last 20 years and the increased NH_4^+ content are related to the significant pollution by organic wastes. The inflowing North Sea waters are a source of oil and detergents. However the level of oil and detergent pollution in the Baltic Sea has decreased in recent years.

[from Chemical Abstracts 88(4):#27552. 1978]

C-0614-78
EFFECTS OF COASTAL POLLUTION ON FISH AND FISHERIES - WITH PARTICULAR REFERENCE TO THE MIDDLE ATLANTIC BIGHT
Sindermann, C. J. 1976.
Symposium on the Middle Atlantic Continental Shelf and the New York Bight, New York, NY, 1975. M. G. Gross (ed.). Lawrence, Kansas, American Society of Limnology and Oceanography, Inc., 1976. Vol. 2. p. 281-301. Special Symposium of the American Society of Limnology and Oceanography.

Petroleum products, Contamination, Fish, Fisheries, Coasts, Atlantic Coast, *Middle Atlantic Bight

The effects of heavy metals, halogenated hydrocarbons, and petroleum products and residues on coastal shellfish and fish resources are assessed. There is abundant evidence for localized contamination of these resources, but as yet there is little specific evidence for widespread damage to major fisheries resource populations resulting from pollution.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11860. 1977]

C-0615-78
THE HEALTH OF THE OCEANS
United Nations Educational, Scientific & Cultural Organization. 1976.
New York, Unipub, 1976. 172p.

Environmental effects, Oceans, Hydrocarbons, Monitoring, Pollution control, UN

This document "assesses, on the basis of the best available scientific information, the nature and extent of pollution in the marine environment. Describes relationship of oceanic to societal time scales, the dynamics of marine pollution, and the levels and effects of halogenated and petroleum hydrocarbons, radioactive substances, heavy metals, and litter in the world's oceans. Discusses the problems of predicting future pollution levels, monitoring programs, and strategies for reducing marine pollution."

[from Maritime Research Information Service Abstracts Vol. 15: #14 148413. 1977]

C-0616-78
SCIENTIFIC STUDIES TO BE CONDUCTED IN RESPONSE TO AN OIL SPILL IN THE BEAUFORT SEA
Ward, J. G., and C. E. Tull. 1977.
Patricia Bay, Victoria, British Columbia, Institute of Ocean Studies, 1977. 151p. Report No. 77-2.

Guidelines, Oil spills, Fate, Behavior, Environmental effects, Arctic, Beaufort Sea, *Scientific response studies

Guidelines are presented for studies to be conducted after a major oil spill in the Beaufort Sea. Important research needs include the immediate and long-term impact of such a spill and the behavior and fate of oil in Arctic marine environments. Thirty scientific response studies are described, and for each the priorities, objectives, methods, timing, relation to other studies, and logistical and funding requirements are outlined and summarized.

[from Aquatic Sciences & Fisheries Abstracts 7(11):#7Q14895. 1977]

C-0617-78
THE ARGO MERCHANT REVISITED
Worthington, V. 1977.
Conservation News 42(15):6-8.

Argo Merchant spill, NOAA, Chronic effects, Marine organisms, Sediments, Fish

The results of a recently released NOAA-sponsored study entitled "The Argo Merchant Oil Spill - A Preliminary Scientific Report" are briefly summarized. This study indicates that, although the short-term effects of the spill appear to have been minimal, the long-term effects and interactions of the oil with sediments and biological communities are as yet unknown. Two further environmental assessment reports by NOAA, dealing with this spill were expected to be released by September and October 1977.

D. ASPECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL ASPECTS

C-0618-78
EFFECTS OF CHEMICALS USED IN OFFSHORE WELL-DRILLING OPERATIONS
Richards, N. L. 1977.
Energy/Environment II - National Conference on the Interagency Research & Development Program, 2nd, Washington, D.C., 1977. p. 509-511. Report EPA-600/9-77-012. (EPA Decision Series)

Offshore drilling, Biological effects, Toxicity, Marine organisms, *Drilling muds

Research needs on the fate and biological effects of drilling mud components are identified. Research in this area is impeded by the chemical complexity of drilling muds and their components, as well as the inapplicability of acute static bioassay tests to actual offshore drilling and discharge conditions. A comprehensive research program, presently underway, is outlined and discussed.

2. PHYSICAL/CHEMICAL ASPECTS

[No entries.]

3. SOCIAL/ECONOMIC ASPECTS

[No entries.]

4. GENERAL ASPECTS

C-0619-78
NORTH SEA CLEAN-UP POSTPONED
Anon. 1977.
Holland Shipbuilding 26(2):70.

North Sea, Oil fields, Oil industry, *Debris and equipment cleanup

Because of rough weather conditions, oil industry cleanup operations in oil field areas of the North Sea have been postponed. The operations are designed to rid abandoned oil exploration and production regions of debris and equipment that was left behind on the seabed.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11880. 1977]

C-0620-78
OIL DRILLING THREAT TO U.S. EAST COAST (news brief)
Anon. 1978.
Marine Pollution Bulletin 9(2):31.

Offshore exploration, EPA, Environmental effects, New Jersey, Maryland

Citizen groups are skeptical of EPA-approved exploratory drilling programs in the area between 80 and 216 km off the coast of New Jersey & Maryland. They argue that even exploratory drilling programs can damage marine ecosystems and pollute ocean and beaches.

C-0621-78
VIRGINIA REFINERY BATTLE: ANOTHER DILEMMA IN ENERGY FACILITY SITING
Carter, L. C. 1978.
Science 199(4329):668-671.

Refineries, Development, EPA, Virginia, *James River

The controversy over the proposed refinery in southeastern Virginia emphasizes the lack of an effective policy for energy facility siting. The EPA, the US Fish and Wildlife Service, and the National Marine Fisheries Service have recommended that a permit be denied which is necessary for tankers to pass through Canadian waters on their way to the refinery site. Permit denial is recommended based on the potential that associated oil spills could ruin the already stressed seed oyster beds in the lower James River.

C-0622-78
OIL SPILLS AND OFFSHORE DRILLING (letter to the editor)
Chaisson, R. E., L. B. Smith, Jr., and J. M. Fay. 1978.
Science 199(4325):128-129.

OCS, Offshore development, Environmental effects, Atlantic Ocean

The authors comment on the shortcomings of the article "Drilling, tankers, and oil spills on the Atlantic outer continental shelf" [Travers and Luney, 1976. Science 194(4267):791-796]. The article assessed various tradeoffs of exploration and development of the Atlantic OCS. The assumption that OCS development would reduce tanker traffic and the assessment of the environmental aspects of the OCS program are questioned.

C-0623-78
ENVIRONMENTAL ASSESSMENT & IMPACT STATEMENT HANDBOOK
Cheremisinoff, P., and A. C. Morresi. 1977.
Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc., 1977.
x & 438p.

Oil spills, Pollution control, Tankers, Platforms, Refineries, Petrochemicals, Manuals, EIS, Environmental protection

The purpose of this book is to "provide a guide of informational requirements for those in industry involved in evaluation and/or preparation of environmental assessments." In the first 4 chapters, the requirements of the National Environmental Policy Act of 1969 and the general criteria and methodology for preparation, evaluation, and analysis of environmental impact statements (EIS) are reviewed. Chapter 8 deals with oil spill impacts, the control and cleanup of oil pollution resulting from offshore platforms, and tanker operations and mishaps. Chapter 11 deals with air and water pollution and waste-treatment and disposal in the petroleum refining and petrochemicals industry.

C-0624-78
PROBLEMS OF OIL DEVELOPMENT IN THE SHETLANDS
Clark, I. 1977.
Oceanic Management - Conflicting Uses of the Celtic Sea and Other Western U.K. Waters. M. M. Sibthorp, and M. Unwin (eds.). London, Europa Publications, 1977. p. 213-217. Report of a Conference held at University College of Swansea, 19-22 September 1975.

Offshore development, Onshore impacts, Socio-economic effects, Oil industry, UK, North Sea, *Shetland Islands

The large-scale North Sea oil development is having major social and economic consequences in the isolated Shetland Islands. The rapid emergence of the oil industry has dwarfed the traditional industries, the influx of imported labor is changing community structure, and the sudden economic infusion to the region is requiring careful and resourceful planning to minimize adverse effects of an oil boom.

C-0625-78
GEORGES BANK IS WINNING FRIENDS, INFLUENCING PEOPLE
Cornell, C. 1978.
National Fisherman 58(12):20-21.

Oil-gas leasing, Fisheries, Legislation, Liability, Compensation, OCS, Georges Bank

Two victories for the protection of the fisheries industry are discussed. In the US House of Representatives, the OCS bill passed and included funds to cover liability for oil spills. In the other battle, over the Georges Bank lease sale, the vulnerability of several fisheries resources to oil spills was cited. A temporary restraining order was issued.

C-0626-78
OIL SHALE AND THE ENVIRONMENT
Environmental Protection Agency. 1977.
Washington, D.C., EPA Office of Research and Development, 1977.
Report EPA-600/9-77-033. 29p. (EPA Decision Series)

Oil shale, Development, Extraction, Environmental effects, Health hazards, Socio-economic effects, Contamination, Restoration

This publication provides a general overview of western US oil shale resources, the mining or _in situ_ extraction processes, and the environmental issues and changes associated with oil shale development and exploitation. Briefly discussed are air pollution aspects, surface water and groundwater contamination, spent shale disposal, land disruption and restoration, health effects, and the socio-economic effects, such as boom towns, associated with oil shale development.

C-0627-78
OFFSHORE DRILLING IN THE LABRADOR SEA - ONE VIEWPOINT
Labrador Resources Advisory Council. 1978.
Spill Technology Newsletter 3(1):41-43.

Environmental effects, Regulations, Offshore drilling, OCS, Canada, Government agencies, *Labrador Sea

The authors note and lament the fact that offshore oil drilling in the Labrador Sea has been subject to much less stringent regulation than similar activity in the Beaufort Sea, even though the offshore Labrador environment is in many ways a more hostile environment, and a potential blowout would have devastating impacts on some of Canada's most productive coastline. The lack of sufficient controls is blamed in part on the insensitivity and oil industry-serving orientation of the regulatory agencies.

C-0628-78
OIL AND GAS EXTRACTION
Larminie, F. G. 1977.
Oceanic Management - Conflicting Uses of the Celtic Sea and Other Western U.K. Waters. M. M. Sibthorp and M. Unwin (eds.). London, Europa Publications, 1977. p. 7-11. Report of a Conference held at University College of Swansea, 19-22 September 1975.

Offshore development, Oil spills, North Sea, Santa Barbara Channel, *Celtic Sea, *Geologic conditions

A verbatim transcript of a report on the general geologic aspects of offshore oil-gas development is presented, focusing on the North Sea and Celtic Sea. The author stresses that a repeat of the Santa Barbara oil spill would not be possible in the Celtic and North Sea because the geologic conditions are very different and far less hazardous than those in the Santa Barbara Channel.

C-0629-78
POLLUTION AND DECONTAMINATION OF A CHRONICALLY OIL-CONTAMINATED
BRACKISH-WATER ENVIRONMENT [in Swedish]
Leppakoski, E. 1976.
NORDFORSK, Miljoevardssekretariatet, Publikation. p. 241-254.

Contamination, Refineries, Wastewaters, Chronic effects, Benthos

"A brackish-water area contaminated for about 30 years by an oil refinery was mapped, and the effect of a radical reduction in oil effluents on the bottom fauna was determined."

[from Chemical Abstracts 87(12):#90475g. 1977]

C-0630-78
MULTIPLE SEA USE
Lighthill, J. 1977.
Interdisciplinary Science Reviews 2(1):27-35.

Offshore development, Onshore impacts, Environmental effects, North Sea, UK

The effects of North Sea oil development on the onshore and offshore UK environment, and the converse effects of the environment on exploitation are considered. The problems of pollution from oil and other wastes are discussed, and the necessity of reconciling the numerous different sea uses within a concept of multiple sea use is stressed.

C-0631-78
NATIONAL CONFERENCE ON COASTAL ZONE MANAGEMENT (3rd)
National Oceanic and Atmospheric Administration. 1975.
Report NOAA-77070508. 412p.

Environmental effects, Legislation, Crude oil, Pollution control, *Coastal Zone Management, *Conference

Panel discussions held during the title conference held in the spring of 1975 are presented. The panels were categorized as follows: energy, technical issues, legal issues, implementation, and participation. Topics covered included environmental impacts, crude oil, and pollution.

[from Government Reports Announcements 77(21):#PB-271 069/7GA. 1977]

C-0632-78
OCS: IS IT WORTH IT?
Pope, M. 1978.
Conservation News 43(3):8-11.

OCS, Offshore development, Economic effects, Environmental effects, Atlantic Ocean

The granting of federal permits for exploratory drilling for oil and natural gas on the Atlantic OCS generates the question of whether economic benefits of development outweigh environmental and other costs. Environmental considerations include the threat of oil spills from tankers and the possibility of a major blowout. In addition to onshore impacts, oil spills could result in losses to fishing and tourist industries.

C-0633-78
CAN THEY HEAD OFF THE TANKERS AT THE PASS?
Schueler, D. G. 1977.
Audubon 79(6):146-148.

Ports, Socio-economic effects, Onshore effects, Environmental effects, Texas, *Superports

A negative review is presented of the socio-economic and environmental effects of the proposed inshore superport facility at Port Aransas, Texas. Problems include the deepening of the existing ship channel from 14 m (45 ft.) to 24 m (80 ft.) and the disposal of dredged mud and sand; an estimated quadrupling of the Corpus Christi refineries and a tripling of the population; a $500 million investment that the taxpayers may end up funding; and the impact on wildlife, the tidal ecosystem, and the tourist and fisheries industries.

C-0634-78
OIL SPILLS AND OFFSHORE DRILLING (letter to the editor)
Stewart, R. J., and J. W. Devanney, III. 1978.
Science 199(4325):125-128.

OCS, Offshore drilling, Tankers, Environmental effects, Economic effects, Atlantic Ocean

The authors cite factual errors, incomplete arguments, and misuse of oil spill statistics in "Drilling, tankers, and oil spills on the Atlantic outer continental shelf" [Travers, W. B., and P. R. Luney. 1976. Science 194(4267):791-796]. Both the letter and the article it responds to conclude with a pro position on Atlantic OCS development based on environmental and economic trade-offs.

C-0635-78
OIL SPILLS AND OFFSHORE DRILLING (letter to the editor)
Travers, W. B., and P. R. Luney. 1978.
Science 199(4325):130-132.

OCS, Offshore drilling, Safety, Environmental effects, Economic effects, Atlantic Ocean

The authors responded to comments on their article "Drilling, tankers, and oil spills on the Atlantic outer continental shelf" (Travers and Luney, 1976. Science 194 (4267):791-796). They reaffirmed the thesis that geologic conditions for oil well drilling are relatively safe. Also discussed were the mission of specific environmental considerations and the potential economic benefits of the OCS program.

C-0636-78
ATLANTIC OFFSHORE USERS WORKSHOP
University of Delaware. 1977.
Newark, Delaware, University of Delaware, Sea Grant College Program, 1977. Report DEL-SG-11-77, NOAA-77081103. 293p.
Held at Clayton Conference Center, University of Delaware, Newark, on May 19-21, 1977.

OCS, Atlantic Ocean, Offshore drilling, Design-engineering, Pollution prevention, Resource management, *Workshop

The purpose of this workshop was to focus on the Atlantic Ocean's future. The objective was to identify the most important oceanographic and offshore engineering problems which, if solved, could improve resource management practices and commercial use. Priority actions necessary for protecting the nearshore Atlantic without disregarding its assets were also determined.

[from Government Reports Announcements 77(23):#PB-271 678/5GA. 1977]

C-0637-78
OIL EXPLORATION IN THE CELTIC SEA: A REVIEW OF THE POLLUTION RISK
Wardley-Smith, J. 1977.
Oceanic Management - Conflicting Uses of the Celtic Sea and Other Western U.K. Waters. M. M. Sibthorp, and M. Unwin (eds.). London, Europa Publications, 1977. p. 45-56. Report of a Conference held at University College of Swansea, 19-22 September 1975.

Offshore drilling, Tankers, Ports, Oil terminals, Sources, Biological effects, UK, North Sea, *Celtic Sea

Oil pollution risks from tankers, offshore oil wells, undersea pipelines, undersea storage facilities, and oil terminals are reviewed, with reference to experience in the North Sea. The author concludes that the vast majority of spills from these sources are of a "minor nature", and that "the main sufferers from oil spills are seabirds, and these only at certain times of the year when they congregate. Man is the other animal at risk, and in his case not to his health but to a loss of amenity and perhaps profit by the pollution of pleasure beaches, small boats, etc."

C-0638-78
PETROLEUM TAINTING IN FISH
Howgate, P., P. R. Mackie, K. J. Whittle, J. Farmer, et al. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:143-146. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Fish, Hydrocarbons, Contamination, Benthos, Sediments, *Petroleum taints

"'Petroleum' taints in fish flesh do not necessarily arise by petroleum contamination. Such taints are well known in certain fisheries and have been traced to natural dietary components. Tainting of the flesh which is due to petroleum contamination, however, is usually accompanied by the presence in the flesh of hydrocarbons derived from the contaminating source, but these hydrocarbons are not necessarily responsible for the taint. Experimental tainting studies on benthic organisms by using sediment contaminated with a North Sea crude oil are described."

C-0639-78
EFFECT OF SURFACE FILMS ON GAS EXCHANGE ACROSS THE AIR-SEA INTERFACE
Liss, P. S. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:120-124. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Oil slicks, Chemical effects, Physical effects, Sea surface, *Surface films, *Gas exchange

Possible effects of surface films in modifying gas exchange across the air-sea interface are investigated. The exchange should be greater for gases whose transfer is controlled by processes in the gas phase (H_2O, SO_2, NO_2), than for those whose exchange is under liquid phase control (N_2, O_2, CO_2, and the inert gases). Significant retardation of gas transfer occurs only under conditions of close packed film material.

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-0640-78
NUMERICAL TAXONOMY AND ECOLOGY OF PETROLEUM-DEGRADING BACTERIA
Austin, B., J. J. Calomiris, J. D. Walker, and R. R. Colwell.
1977.
Environmental Microbiology 34(1):60-68.

Biodegradation, Chemical analysis, Bacteria, Statistical analysis, *Taxonomy, *Ecology, Chesapeake Bay

A total of 99 strains of petroleum-degrading bacteria isolated from Chesapeake Bay water and sediment samples were identified using numerical taxonomy procedures. The isolates, and 33 reference cultures, were examined for 48 biochemical, cultural, morphological and physiological characters and the resultant data were analyzed by computer. Petroleum degradation is apparently accomplished by a diverse range of bacterial taxa, some of which were present only at specific stations or from sediment samples at specific stations.

C-0641-78
MICROBIOLOGICAL STUDIES OF THE ATLANTIC CONTINENTAL SHELF
Colwell, R. R., J. D. Walker, G. S. Sayler, and B. F. Conrad.
1976.
Symposium on the Middle Atlantic Continental Shelf and the New York Bight, New York, NY, 1975. M. G. Gross (ed.). Lawrence, Kansas, American Society of Limnology and Oceanography, Inc., 1976. Vol. 2. p. 281-301. Special Symposium of the American Society of Limnology and Oceanography.

Biodegradation, Crude oil, Hydrocarbons, Microorganisms, Bacteria, Atlantic Ocean, Sediments, Seawater

The microbial degradation of petroleum and other organic substances was investigated under field and laboratory conditions, and the results are presented. Bacteria were more abundant on mixed hydrocarbon substrates than on a representative crude oil. Deep ocean sediment bacteria were better able to degrade crude oil than microorganisms from surficial waters. Presence of oil-degrading microbial types are potential indices of oil contamination.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11880. 1977]

C-0642-78
COMPARISON OF TWO METHODS FOR EVALUATING THE BIODEGRADATION OF HYDROCARBONS IN VITRO [English summary]
Fusey, P., and J. Oudot. 1976.
Material und Organismen 11(4):24-251.

Biodegradation, Chemical analysis, Crude oil, Microorganisms, Analytical techniques, *Comparisons

Several parameters affecting the in vitro biodegradation of hydrocarbons by soil microorganisms were studied. Crude oil vs. topped crude oil; the influence of static aeration: cotton-stoppered vs. hermetically sealed flasks; and the influence of gravimetry vs. IR spectrophotometry were compared. Cotton stoppered flasks and topped crude oil were preferred. Gravimetry was useful for >100 mg samples of oil, and IR spectrophotometry was more rapid but led to overestimation of biodegradation.

[from Biological Abstracts 64(11):#62271. 1977]

C-0643-78
RATE MEASUREMENTS AND RATE-LIMITING FACTORS IN OIL BIODEGRADATION IN THE MARINE ENVIRONMENT
Gibbs, C. F. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:129-138. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Biodegradation, Uptake, Fate, *Degradative capacity

The interpretation and relevance of different measurements of oil biodegradation are discussed, e.g. oxygen uptake, recovery of oil, etc., in light of the various factors which may drastically affect the rate of degradation. "The concepts of degradative capacity of a given body of water viz. the degradation rate of a small amount of oil in unlimited water are considered."

C-0644-78
EFFECTS OF LEAD ON BIODEGRADATION OF HYDROCARBONS IN SOIL
Jensen, V. 1977.
Oikos 28(2-3):220-224.

Biodegradation, Hydrocarbons, Soil, Bacteria, Fungi, *Lead

Addition of lead was found to result in a general reduction of bacterial populations and a proliferation of several fungal species. Simple alkanes were readily utilized in the presence of high lead concentrations, but biodegradation of complex mixtures of hydrocarbons was significantly retarded by presence of lead.

[from Chemical Abstracts 87(13):#101227f. 1977]

C-0645-78

THE FATE AND EFFECT OF PETROLEUM IN CONTROLLED ECOSYSTEM ENCLOSURES

Lee, R. F., and M. Takahashi. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:150-156. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Biodegradation, Fuel oil, Phytoplankton, Zooplankton, Distribution, Ecosystems

Water extracts of No. 2 fuel oil were added to controlled ecosystem pollution experiments (CEPEX) enclosures. At lower concentrations, no major effects on phytoplankton or zooplankton were observed. Higher concentrations of fuel oil, (40 μg/L nonvolatile petroleum) caused a major change in the structure of the ecosystem of the enclosure as reflected in the type of primary and secondary producers.

C-0646-78

THE BIODEGRADATION OF OIL IN SEAWATER FOR NAVAL POLLUTION CONTROL

O'Neill, T. B. 1977.
Report AD-A042 375. 12p. Final report for 1974-1976.

Biodegradation, Crude oil, Fuels, Seawater, Microorganisms, Pollution control

"The report describes the isolation and utilization of pure and mixed microbial cultures for experiments on the biodegradation of crude oil, Bunker C fuel, and marine diesel. Many microbial species were found that had hydrocarbonoclastic activity. When pure cultures were combined in mixtures the activity was much greater, 91% oxidation in seven days, than the activity of any one of the component species when used in a pure culture."

[from Government Reports Announcements 77(21):#AD-A042 375/6GA. 1977]

C-0647-78

DEGRADATION OF HYDROCARBONS AND MIXED HYDROCARBON SUBSTRATE BY MICROORGANISMS FROM CHESAPEAKE BAY

Walker, J. D., and R. R. Colwell. 1975.
Progress in Water Technology 7(3/4):783-791.

Biodegradation, Aromatic hydrocarbons, Microorganisms, Bacteria, Sediments, Chesapeake Bay

Microorganisms isolated from Colgate Creek in Baltimore Harbor of Chesapeake Bay were capable of degrading paraffinic, mono-, and dicyclic aromatic hydrocarbons of the type occurring in sediment from that area. Higher numbers of petroleum-degrading bacteria were found in Poole's Island samples; these bacteria may be responsible for the oil content reduction.

2. PHYSICAL/CHEMICAL CHANGES

C-0648-78
TRANSFER OF PETROLEUM RESIDUES FROM SEA TO AIR: EVAPORATIVE WEATHERING
Butler, J. N. 1976.
Marine Pollutant Transfer. H. L. Windom, and R. A. Duce (eds.). Lexington, Massachusetts, Lexington Books, D. C. Heath and Company, 1976. p. 201-212.

Hydrocarbons, Tar, Evaporation, Models, Sea surface, Weathering

A simple semiquantitative model of evaporative weathering is developed which predicts the transport of petroleum components from the sea surface to the atmosphere. The rate of transfer is estimated by equations, and critical factors are discussed. The author proposes that although there is little data available on the residence time of pelagic tar, it appears that evaporation is probably the most important weathering process for at least several months of the life of the petroleum residue on the sea surface.

C-0649-78
STUDIES ON THE CHANGE OF SPILLED OIL WITH THE TIME ELAPSED. IV. WEATHERING TEST OF C FUEL OIL [in Japanese]
Higashi, K., S. Honda, T. Saito and K. Kazuyoshi. 1977.
Osaka Kogyo Gijutsu Shikensho Kiho 28(1):63-69.

Weathering, Fuel oil, Emulsions, Seawater, Chemical analysis

An experiment is described wherein fuel oil was agitated with synthetic seawater to form a water-in-oil emulsion. The viscosity, specific gravity, color, odor, UV absorbance, water content, etc., were checked over a period of several days. The findings are presented.

[from Chemical Abstracts 87(24):#186765c. 1977]

C-0650-78
PILOT PLANT INVESTIGATION OF THE EVOLUTION OF VARIOUS POLLUTANTS DURING ARTIFICIAL RECHARGE OF AN AQUIFER BY A BASIN
Rizet, M., J. Mallevialle, and J.-C. Cournarie. 1977.
Progress in Water Technology 9(1):203-215.

Physical effects, Movement, Hydrocarbons, Wastewaters, Groundwater, Freshwater, *Aquifer

An artificial recharge pilot plant was used to investigate the evolution of various contaminants in the charging basin and successive soil zones. Introduced pollutants included 2.5 mg/L of phenol, 12.5 mg/L of a soluble oil (mixture of hydrocarbons and surfactants), and 300 mg/L of a refinery effluent. A penetration delay of 24 hrs was observed for the refinery effluent; while the phenol and hydrocarbon solutions penetrated the surface layers of the terrane during the first hours, and were stopped by adaptation of the biotope. Hydrocarbons created the only significant biotic modifications by formation of a surface film.

C-0651-78
CHANGES IN THE NATURE OF CRUDE OILS AND HEAVY FUEL OILS EXPOSED ON THE SEA SURFACE [in Japanese]
Utashiro, S. 1975.
Kaijo Hoan Daigakko Kenkyu Hokoku, Dai-2-Bu No. 21:13-29.

Crude oil, Fuel oil, Fate, Sea surface, Chromatography, Spectroscopy, *Refractive index

Crude oils and heavy fuel oils exposed on the sea are studied by refractive index measurement, gas chromatography, and IR spectroscopy. The various study methods are explained and discussed in a comparative manner.

[from Chemical Abstracts 87(24):#186772c. 1977]

C-0652-78
CHANGES IN THE NATURE OF CRUDE OILS AND HEAVY FUEL OILS EXPOSED ON THE SEA SURFACE (2nd Report) [in Japanese]
Utashiro, S. 1976.
Kaijo Hoan Daigakko Kenkyu Hokoku, Dai-2-Bu No. 22:1-30

Crude oil, Fuel oil, Fate, Sea surface, Chemical analysis, Analytical techniques

Two heavy fuel oils and 4 crude oils were examined using gas chromatography, sulfur compound analysis, IR spectroscopy, and refractive index measurement methods. These techniques are discussed and compared.

[from Chemical Abstracts 87(24):#186773d. 1977]

3. GENERAL FATE OF OIL

C-0653-78
USGS STUDY PREDICTS EFFECTS OF NORTH ATLANTIC SPILLS
Anon. 1976.
Petroleum Engineer 48(December):10,14.

Statistical analysis, Oil spills, Beaches, Georges Bank, Atlantic Coast, USGS

In a USGS study released in October 1976, new statistical approaches and computer simulations were used to estimate the oil spill risks associated with offshore drilling on the Georges Bank. The analysis, designed to provide the most pessimistic but statistically valid forecasts of oil spill risks indicates that the probability of a major oil spill washing ashore on Atlantic beaches is over 90% over a 20-year period, and that over that time up to 1130 kg/km (4000 lbs/mile) of petroleum residues would come ashore. Nantucket Island, parts of Cape Cod, and southern Nova Scotia would be hardest hit.

C-0654-78
TREATMENT AND NATURAL FATE OF OIL SPILLAGES
Beastall, S. 1977.
Treatment of Industrial Effluents. A. G. Callely, C. F. Forster, and D. A. Stafford (eds.). 1977. London, Hodder and Stoughton Ltd., 1977. p. 328-335.

Sources, Contamination, Fate, Biodegradation, Spill cleanup, Sinking agents, Dispersants

The major sources of marine oil pollution, the basic composition of oil, and the general fate and biodegradation of oil spills at sea are summarized. The treatment of oil spills is reviewed and it is concluded that sinking and dispersing of oil are the only two successful methods of dealing with spilled oil in the open sea. However, the sinking of oil may present long-term repollution problems, as sunken oil is slowly released to the benthic environment.

C-0655-78
THE NATURAL AND CHEMICAL DISPERSION OF OIL IN THE SEA
Cormack, D., and J. A. Nichols. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:97-100. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Oil slicks, Dispersions, Fate, Dispersants, UK

"Experiments on the fate of oil slicks at sea suggest that natural physical dispersion of the oil into the upper layers may account for the removal of up to 40% of the oil from the surface in the first 8 hours without the development of high concentrations in the water." Wind and wave conditions, hydrocarbon concentrations at various depths beneath oil slicks, and the role of chemical dispersants in treating oil slicks are discussed.

C-0656-78
FATE OF HYDROCARBONS IN SOILS [in French]
Desgranges, P., T. Gugalski, C. Vilbert, et al. 1976.
Reunion Annuelle des Sciences de la Terre, Paris, 1976. Programme resumes, No. 4 p. 136. Abstract

Hydrocarbons, Soil, Fate, Biodegradation

Summary not available.

[from Bibliography and Index of Geology 41(4):#12365. 1977]

C-0657-78

THE INTERACTION OF CRUDE OIL WITH ARCTIC SEA ICE

Dickins, D., J. Overall, and R. Brown. 1975.

Yellowknife, Northwest Territories, NORCOR Research and Engineering Ltd., 1975. Technical report, DSS Contract OSV4-0043.

Behavior, Crude oil, Ice, Arctic, *Oil-ice interactions

Summary not available.

[from AIDJEX Bulletin No. 33:49. 1976]

C-0658-78

PHOTODEGRADATION OF HYDROCARBON SURFACE FILMS

Hansen, H. P. 1977.

Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:101-106. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Fate, Crude oil, Hydrocarbons, Chemical analysis, Weathering, *Photodegradation

Photodegradation experiments were conducted on crude oil surface films. Compositional changes were studied; isolated degradation products were predominantly aromatic and aliphatic acids. A possible reaction scheme was then developed to suggest effects upon the marine environment.

C-0659-78

ALTERATIONS IN PETROLEUM RESULTING FROM PHYSICO-CHEMICAL AND MICROBIOLOGICAL FACTORS

Karrick, N. L. 1977.

Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms. Vol. I. Nature and Fate of Petroleum. D. C. Malins (ed.). New York, Academic Press, Inc., 1977. p. 225-299.

Physical effects, Chemical effects, Biodegradation, Fate, Crude oil, Microorganisms, Arctic

Physical, chemical and microbiological processes that result in the alteration of oil contaminants in the marine environment are reviewed. The interdependency of these processes is stressed, as is the nearly infinite number of variables that influence the rate, nature and extent of such reactions. Microbiological processes and microbial activity as related to hydrocarbon degradation is compared for arctic and temperate waters. A list of 220 references is appended to this chapter (Chapter 3).

C-0660-78
OIL IN THE OCEAN: CIRCUMSTANCES CONTROL ITS IMPACT
Kerr, R. A. 1977.
Science 198(4322):1134-1136.

Fate, Sources, Argo Merchant spill, Torrey Canyon, *Florida

An overview of sources, types, and fate of oil entering the ocean is presented. The author discusses directions of oil pollution research and notes that large spills from tankers receive most of the research attention, although tanker accidents are responsible for only a few percent of the oil entering the marine environment. A control spill study ecosystem is also discussed.

C-0661-78
FATE AND EFFECT OF NAPHTHALENES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Lee, R. F., and J. W. Anderson. 1976.
Report NSF/IDOE-77-104-15. 9p.

Aromatic hydrocarbons, Fate, Biodegradation, Crustaceans, Phytoplankton, Sedimentation, *Naphthalenes

A nominal naphthalene concentration of 160 μg/L was reduced by 50% one day after the addition of naphthalenes to a CEPEX enclosure. Concentrations gradually decreased to near background levels during the following 20 days. Most of the naphthalene decrease was due to adsorption to sinking phytoplankton and microbial degradation. An immediate decline in the phytoplankton populations of both treated and control enclosures was observed, and 3.2 g of naphthalenes were associated with sediment.

[from Government Reports Announcements 77(22):#PB-270 147/2GA. 1977]

C-0662-78
THE GEOGRAPHICAL DISTRIBUTION OF TAR IN THE NORTH ATLANTIC
Levy, E. M. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:55-60. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Tar, Fate, Distribution, Sea surface, Atlantic Ocean, Sargasso Sea, *North Atlantic

Results from 1971-1974 in a continuing study of tar distribution on the surface of the North Atlantic are presented. Virtually no tar pollution was found in the waters to the north and west of the Gulf Stream/North Atlantic Current system. Highest concentrations were observed in the Sargasso Sea. The surface circulation of the North Atlantic and areas of input were also evaluated.

C-0663-78
ARCTIC OIL SPILLS
MacKay, D., and G. Green. 1975.
Chem 13 [Thirteen] News, No. 70:3-5.

Weathering, Oil spills, Aromatic hydrocarbons, Biodegradation, Toxicity, Arctic

Oil spills are weathered, or aged, by evaporation, dissolution, biodegradation, and emulsification. The aromatic hydrocarbons are most toxic to fish and animals, and evaporate most rapidly. *n*-Alkanes are the most readily biodegradable.

[from Chemical Abstracts 87(24):#186767e. 1977]

C-0664-78
TRANSFER OF PARTICULATE HYDROCARBON MATERIAL FROM THE OCEAN SURFACE TO THE WATER COLUMN
Morris, B. F., J. N. Butler, T. D. Sleeter, and J. Cadwallader. 1976.
Marine Pollutant Transfer. H. L. Windom, and R. A. Duce (eds.). Lexington, Massachusetts, Lexington Books, D. C. Heath and Company, 1976. p. 213-234.

Tar, Fate, Decomposition, Sampling, Sargasso Sea, Source identification

The fate of pelagic tar is reviewed. Physical and chemical characteristics of particles are discussed in detail; and source identification, sampling, and measurement methods are evaluated. Estimated concentrations of tar particles within the upper 100 m of the Sargasso Sea show 0.4 mg/m^3 from visual counts, and 3 mg/m^3 from filter extracts. Considering the inaccuracies, a steady-state model implies a residence time for suspended tar particles of the order of years.

C-0665-78
OIL-IN-ICE STUDIES
Rosenegger, L. W. 1975.
Calgary, Alberta, Imperial Oil Co. Ltd., Resource Production and Technical Services Laboratory, 1975. Laboratory Report L-12075.

Behavior, Crude oil, Ice, Arctic, *Oil-in-ice

Summary not available.

[from AIDJEX Bulletin No. 33:52. 1977]

C-0666-78
ANALYZING TAR IN THE SARGASSO SEA
Wade, T. L., and J. G. Quinn. 1977.
Maritimes 21(2):1-2.

Tar, Fate, Distribution, Source identification, Weathering, Chromatography, Sargasso Sea

Pelagic tar from the Sargasso Sea was collected and analyzed to gather information on its source, distribution, and chemical composition. Gas liquid chromatography analyses were made to determine sources, ages, and weathering characteristics of the tar. It was also found that small tar particles in the size range of 0.3 μ to 1.0 mm represent a large fraction of the hydrocarbons in the water samples taken.

C-0667-78
MARINE POLLUTANT TRANSFER
Windom, H. L., and R. A. Duce (eds.). 1976.
Lexington, Mass., D. C. Heath and Company, 1976. 392p.

Fate, Hydrocarbons, Weathering, Physical effects, *Pollutant transfer

The book contains 14 chapters all concerned with the transfer of various pollutants (including petroleum hydrocarbons) across the primary interfaces between the ocean and other environments. Petroleum-related chapters are: Chater 8, The Flux of Light Hydrocarbons into the Gulf of Mexico via Runoff; Chapter 9, Transfer of Petroleum Residues from Sea to Air: Evaporative Weathering; Chapter 10, Transfer of Particulate Hydrocarbon Material from the Ocean Surface to the Water Column; and Chapter 11, Transfer of Petroleum and Biogenic Hydrocarbons in the Sargassum Community.

C-0668-78
SORPTION OF BENZENE ON PARTICULATE MATTER FROM THE SEA
Zsolnay, A. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:117-119. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Adsorption, Absorption, Behavior, Plankton, *Benzene

"The sorption of benzene on particulate material occurring naturally in sea water before, during and after a plankton boom was studied. Sorption was significant, ranging from 4.8 to 28.4 μg benzene sorbed per mg of particulate material. The greatest amount of sorption took place during the plankton bloom, when the number of particles was also greatest."

4. MODELS AND PREDICTIONS

C-0669-78
THE ENVIRONMENT: THEORETICAL WORK ON OIL SLICKS (news brief)
Anon. 1978.
Chemistry in Canada 30(1):18.

Models, Fate, Spill cleanup, Oil slicks, *Theoretical predictions

Theoretical predictions are the goal of research on the spreading behavior of oil on water. Dr. R. Cox, of McGill University, Montreal is conducting the theoretical and experimental work. Cox's objective is to quantitatively describe the dynamic behavior of films. This research would be useful in the control and cleanup of oil slicks.

C-0670-78
THE APPLICATION OF A TWO-LAYER TIME-DEPENDENT MODEL TO POLLUTION ASSESSMENT AND CONTROL IN A SHORT STRATIFIED ESTUARY
Pitblado, R. M., and R. G. H. Prince. 1977.
Progress in Water Technology 9(1):217-231.

Models, Pollution control, Source identification, Sampling, Estuaries

The title model is possibly relevant to oil pollution research. Applications include: "the assessment of priorities in a pollution abatement program for estuaries subject to major transient polluting loads; . . . [identification of] the nature and location of significant polluting discharges; . . . [and] the organisation of sampling programs and the interpretation of the data."

C-0671-78
THE FLOW STRUCTURE OF AN UNDERWATER OIL BLOWOUT
Thornton, D. E. 1978.
Spill Technology Newsletter 3(1):44-57.

Blowouts, Fate, Behavior, Arctic, *Flow structure

A discussion of the likely behavior and fate of oil released from a subsea blowout (200 m depth) is presented, using a hypothetical scenario involving an oil flow rate of 15,000 bbl/day, and a gas flow rate of 360,000 m^3/day, under arctic ocean conditions.

C-0672-78
SEDIMENTATION OF DISPERSED OIL IN SURFACE WATERS
Thüer, M., and W. Stumm. 1977.
Progress in Water Technology 9(1):183-194.

Models, Sedimentation, Dispersions, Hydrocarbons, Freshwater, *Coagulation

"A simple model based on surface charge densities and mass densities of the hetero-colloids coagulating predicts the conditions under which dispersed oil becomes agglomerated and evaluates whether the agglomerates formed will settle or rise."

C-0673-78
EFFECTS OF HYDRODYNAMIC PROCESSES ON THE DEVELOPMENT OF GROUND-WATER POLLUTION: STUDY ON PHYSICAL MODELS IN A SATURATED POROUS MEDIUM
Zilliox, L., and P. Muntzer. 1975.
Progress in Water Technology 7(3/4):561-568.

Models, Petroleum products, Contamination, Groundwater, *Hydrodynamics

A laboratory study of pollution of an aquifer through 1) seepage by a soluble chemical substance (brine) and 2) contacts with an impregnation body (petroleum product) is discussed. In the second case, a physical model was used, several variables were considered, and 4 tests of 3-15 wks duration were conducted. A decrease in concentration and in the coefficient of exchange was observed.

F. OIL POLLUTION REGULATIONS

1. STATE LEGISLATION

[No entries.]

2. US LEGISLATION

C-0674-78
SENATE PASSES OIL TANKER SAFETY BILL WITH DOUBLE BOTTOM, BALLAST REQUIREMENTS
Anon. 1977.
Environment Reporter 8(5):171-172.

Tankers, Design-engineering, Safety, US, Regulations, Legislation, Segregated ballast

Passage of Senate Bill S682, which requires minimal construction and operating standards for all tankers entering US ports is detailed. By 1979, all tankers over 20,000 dwt will have to be equipped with dual radar systems, plus collision avoidance systems and navigation aids. By June 1983, segregated ballast systems, a gas inerting system, and position-fixing instrumentation will be required, and for post 1980-built ships, a double bottom will be mandatory.

C-0675-78
US SENATE APPROVES OIL SPILL FUND (news brief)
Anon. 1977.
Water & Pollution Control 115(12):4.

Legislation, US, Liability, Compensation, Oil industry, Tankers, Oil terminals, *Oil spill fund

The US Senate Commerce Committee has approved legislation which establishes strict liabilities for oil spills and creates a fund to pay for damages and cleanup expenses which are not covered. The legislation would also establish strict liability for owners and operators of vessels, oil terminals, refineries and other oil-related facilities that are potential polluters.

3. INTERNATIONAL LEGISLATION

C-0676-78
THE INTERNATIONAL POLITICS OF MARINE POLLUTION CONTROL (book review)
Miles, E. 1975.
American Fisheries Society. Transactions 104(2):416-417.

Pollution control, Contaminants, Legislation, International agreements, Book review

The title book [Shinn, R. A. New York, Praeger Publishers, Inc., 1974. xvii & 200p.] is critically reviewed. It is suggested that much recent literature was overlooked, dating the material significantly. The book includes a summary of types, sources, quantities, and effects of marine pollutants; a brief review of international law and organizations concerned with marine pollution; discussion of specific conferences; and the author's own recommendations.

C-0677-78
RESULTS OF THE THIRD LAW OF THE SEA CONFERENCE 1974 TO 1976: DEPARTMENT OF STATE
[US Department of State]. 1977.
Report to the Congress, ID-77-37, June 3, 1977. 44p.

Legislation, Offshore development, Environmental protection, *Treaty, *Law of Sea Conference

"The purpose of the Conference is to reach agreement on a comprehensive treaty covering all the uses of the oceans." Issues include coastal states' rights to the mineral resources of the continental shelf, exploitation of deep seabed minerals, environmental protection, and a system for settling disputes arising from the interpretation and application of the treaty.

[from Government Reports Announcements 77(20):#PB-268 763/OGA. 1977]

4. FOREIGN LEGISLATION

[No entries.]

5. STANDARDS AND GUIDELINES

C-0678-78
DNV ISSUES GUIDELINES FOR FLOATING RECEPTION FACILITIES
Anon. 1977.
Holland Shipbuilding 26(3):76.

Guidelines, Pollution prevention, Wastewaters, Oil terminals, Safety, *Floating reception facilities

Det Norske Veritas has issued guidelines related to the construction and safe, pollution-free operation of floating oil reception facilities. The guidelines call for a water discharge from such facilities of less than 10 ppm oil.

[from Aquatic Sciences & Fisheries Abstracts 7(9):#7Q11969. 1977]

C-0679-78
GUIDELINES FOR THE DESIGN AND CONDUCT OF OCS OIL AND GAS DEVELOPMENT ENVIRONMENTAL BASELINE STUDIES
U.S. Outer Continental Shelf Environmental Studies Advisory Committee. 1976.
OCS Environmental Studies Advisory Committee, Ad Hoc Committee for Design of Baseline Studies, 1976. 34p.

Guidelines, Offshore development, OCS, Oil-gas leasing, Baseline studies

Summary not available.

[from Bibliography and Index of Geology 41(6):#23271. 1977]

6. AGREEMENTS AND CONVENTIONS

C-0680-78
EKOFISK SPEEDS LIABILITY PACT (news brief)
Anon. 1977.
Offshore England No. 6:27.

Ekofisk blowout, Liability, Compensation, International conventions

The Ekofisk blowout incident is speeding ratification of a much-delayed intergovernmental convention on civil liability for oil pollution damage. Once enacted, the convention will provide compensation to victims of pollution resulting from offshore oil operations, and the victim can submit a claim either in the courts of the country where the damage occurred, or the country in which the damaging pollution originates.

[from Aquatic Sciences & Fisheries Abstracts 7(10):#7Q13394. 1977]

C-0681-78
INTERNATIONAL SHIPOWNERS PROVIDE POLLUTION CODES
Anon. 1976.
Transport Development News 1976:18

Pollution prevention, International conventions, Tankers

The International Chamber of Shipping, comprised of ship-owner associations from 25 countries, is inviting oil tanker charterers and owners worldwide to accept a voluntary code for reducing oil pollution. The code embodies some provisions of the 1973 Marine Pollution Convention which seem immediately enforceable without waiting for the necessary governmental action. The need for cooperation between the tanker owner and the charterer is recognized, but as this is a voluntary code, ample "escape clauses" are provided for any signatory wishing to sidestep its obligations.

[from Maritime Research Information Service Abstracts Vol. 15: #14 142624. 1977]

C-0682-78
GREAT LAKES WATER QUALITY AGREEMENT
Bruce, J. P., and P. M. Higgins. 1977.
Progress in Water Technology 9(1):13-31.

International agreements, Great Lakes, Water quality, US, Canada, Pollution control

"The 1972 Agreement between the United States of America and Canada on Great Lakes Water Quality provides the means to achieve improved water quality in the Great Lakes System through the adoption of common objectives, the development and implementation of cooperative programs and other measures, and the assignment of special responsibilities and functions to the International Joint Commission." Pollution control achievements are reviewed including a brief summary of shipping and oil pollution prevention.

C-0683-78
WHY DO MARINE POLLUTION CONVENTIONS TAKE SO LONG TO ENTER INTO FORCE?
Churchill, R. 1976.
Maritime Policy and Management 4(1):41-49.

International conventions, Pollution control, *Ratification

A general framework of inquiry for use in ascertaining the speed and degree of ratification of any particular convention is presented. Included are tables of pollution control conventions (multilateral and regional), and a table listing the countries that have ratified various conventions.

[from Maritime Research Information Service Abstracts Vol. 15:#14 141604. 1977]

C-0684-78
OIL SPILLS: A COMMENT
Hetherington, A. S. M. 1978.
Marine Technology Society Journal 11(4/5):37.

Tankers, Liability, International agreements, Compensation, *Argo Merchant* spill

The author comments on compensation measures omitted in "Oil spills: issues and actions" [Leitzell, T. L. 1977. Marine Technology Society Journal 11(1):26-29]. Most tanker owners subscribe to Tanker Owners Voluntary Agreement concerning Liability for Oil Pollution (TOVALOP), created to provide compensation to Governments. TOVALOP is relevant currently in the US as a potential source of damage compensation from the *Argo Merchant* incident.

G. BIBLIOGRAPHIES

C-0685-78
ACTIVATED SLUDGE TREATMENT (CITATIONS FROM THE NTIS DATA BASE)
Brown, R. J. 1977.
Report NTIS/PS-77/0812. 341p. Report for 1964-Aug. 1977.
(Supersedes NTIS/PS-75/589, NTIS/PS-74/097.)

Bibliographies, Activated sludge, Wastewater treatment, Industries, Pollution control, Cost analysis

This updated bibliography contains 336 abstracts, 36 of which are new entries, concerning activated sludge treatment of municipal, industrial, and agricultural wastes. Reports dealing solely with sludge disposal are excluded.

[from Government Reports Announcements 77(23):#NTIS/PS-77/0812/6GA. 1977]

C-0686-78
ACTIVATED SLUDGE TREATMENT. VOLUME 2. JANUARY 1976 - SEPTEMBER 1977 (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Brown, R. J. 1977.
Report NTIS/PS-77/0813. 229p. (Supersedes NTIS/PS-76/0758.)

Bibliographies, Activated sludge, Wastewater treatment, Industries, Pollution control, Cost analysis

This updated bibliography contains 222 abstracts, 129 of which are new entries, concerning activated sludge treatment of municipal, industrial, and agricultural wastes. Topics covered include best technology, biochemical processes, conversion, design, deterioration, microbiology, utilization, and inactivation of viruses.

[from Government Reports Announcements 77(23):#NTIS/PS-77/0813/4GA. 1977]

C-0687-78
OZONIZATION USED IN WATER AND SEWAGE TREATMENT (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0749. 186p. Report for 1970 - Aug. 1977.
(Supersedes NTIS/PS-76/0656.)

Bibliographies, Wastewater treatment, Industries, Pollution control, Design-engineering, *Ozone

This updated bibliography contains 179 abstracts, 34 of which are new entries, covering worldwide research reports on the use of ozone in treatment of industrial wastewater, sewage, and drinking water. System design, operation, costs, and comparisons to other methods are covered.

[from Government Reports Announcements 77(22):#NTIS/PS-77/0749/0GA. 1977]

C-0688-78
OZONIZATION USED IN WATER AND SEWAGE TREATMENT (CITATIONS FROM THE NTIS DATA BASE)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0748. 77p. Report for 1970 - Aug. 1977.
(Supersedes NTIS/PS-76/0655.)

Bibliographies, Wastewater treatment, Industries, Pollution control, Equipment, *Ozone

This updated bibliography contains 72 abstracts, 24 of which are new entries, which cite Federally-funded research on the use of ozone in treatment of industrial wastewater, sewage, and drinking water. Treatment, tests, equipment performance, and the effectiveness of ozone in water pollution control are discussed.

[from Government Reports Announcements 77(22):#NTIS/PS-77/0748/2GA. 1977]

C-0689-78
WASTE TREATMENT BY REVERSE OSMOSIS AND MEMBRANE PROCESSES (CITATIONS FROM THE NTIS DATA BASE)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0740. 185p. Report for 1964 - Aug. 1977.
(Supersedes NTIS/PS-76/0652, NTIS/PS-75/574, and NTIS/PS-75/017.)

Bibliographies, Wastewater treatment, Industries, Ultrafiltration, Pollution control, Design-engineering, *Membranes

This updated bibliography contains 180 abstracts, 35 of which are new entries, of Federally-funded research on the treatment of sewage and industrial wastes by reverse osmosis, ultrafiltration, electrodialysis, and other osmotic processes.

[from Government Reports Announcements 77(22):#NTIS/PS-77/0740/9GA. 1977]

C-0690-78
WASTE TREATMENT BY REVERSE OSMOSIS AND MEMBRANE PROCESSES. PART 2. INDUSTRIAL. VOLUME 1. 1970-1975 (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0742. 213p. Report for 1970-1975.

Bibliographies, Wastewater treatment, Industries, Ultrafiltration, Pollution control, Design-engineering, *Membranes

This updated bibliography contains 206 abstracts, none of which are new entries to the previous edition, covering worldwide research on the use of membranes in industrial wastewater treatment. Reverse osmosis, ultrafiltration, electrodialysis, ultrathin, and other osmotic processes are reviewed.

[from Government Reports Announcements 77(22):#NTIS/PS-77/0742/5GA. 1977]

C-0691-78

WASTE TREATMENT BY REVERSE OSMOSIS AND MEMBRANE PROCESSES. PART 2. INDUSTRIAL. VOLUME 2. 1976 - AUGUST 1977 (CITATIONS FROM THE ENGINEERING INDEX DATA BASE)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0743. 90p. Report for 1976 - Aug. 1977. (Supersedes NTIS/PS-76/0654.)

Bibliographies, Wastewater treatment, Industries, Ultrafiltration, Pollution control, Design-engineering, *Membranes

This updated bibliography contains 83 abstracts, 50 of which are new entries, concerning worldwide research on the use of membranes in industrial wastewater treatment. Reverse osmosis, ultrafiltration, electrodialysis, ultrathin, and other osmotic processes are covered.

[from Government Reports Announcements 77(22):#NTIS/PS-77/0743/3GA. 1977]

C-0692-78

WASTEWATER EFFLUENT GUIDELINES AND PERFORMANCE STANDARDS USING BEST TECHNOLOGY (A BIBLIOGRAPHY WITH ABSTRACTS)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0774. 152p. Report for 1964 - Sep 1977. (Supersedes NTIS/PS-76/0633.)

Bibliographies, Wastewater treatment, Guidelines, Standards, Pollution control, Economic effects, Environmental effects

Presented are 147 abstracts, 16 of which are new entries, describing the title issues necessary for implementation of the Federal Water Pollution Control Act Amendments of 1972. Economic and environmental impacts are included in the studies abstracted. "Effluent limitations guidelines are set forth for the degree of effluent reduction attainable through the application of the 'Best Technology Economically Achievable', which must be achieved by existing point sources by July 1, 1977 and July 1, 1983 respectively."

[from Government Reports Announcements 77(22):#NTIS/PS-77/0774/8GA. 1977]

C-0693-78

WATER POLLUTION ECONOMICS. VOLUME 2. 1975 - SEPTEMBER, 1977 (A BIBLIOGRAPHY WITH ABSTRACTS)
Cavagnaro, D. M. 1977.
Report NTIS/PS-77/0784. 188p. Report for 1964 - Sep 1977. (Supersedes NTIS/PS-76/0666, NTIS/PS-75/537, and NTIS/PS-74/094.)

Bibliographies, Economics, Pollution control, Cost analysis, Industries, Wastewater treatment

This updated bibliography contains 183 abstracts, 97 of which are new entries, covering all aspects of the economics of water pollution control and management (excluding sewage treatment) concerning industrial cleanup, government planning, resource management, and urban planning. The economic impacts of pollution and its control are also reviewed.

[from Government Reports Announcements 77(23):#NTIS/PS-77/0784/7GA. 1977]

C-0694-78
OIL SPILL REMOVAL TECHNIQUES AND EQUIPMENT (A BIBLIOGRAPHY WITH ABSTRACTS)
Smith, M. F. 1977.
Report NTIS/PS-77/0750, 279p. Report for 1965 - Sep 1977.
(Supersedes NTIS/PS-76/0637, NTIS/PS-75/542, and COM-74-10951.)

Bibliographies, Spill cleanup, Equipment, Oil-water separation, Spreading, Dispersants

This updated bibliography contains 274 abstracts, 27 of which are new entries, covering oil-water separators, skimmers, dispersants, adsorbents, flotation, and combustion. Related studies on oil spreading, droplet entrainment, prototype removal systems, equipment, and costs are also included. Oil-water separators specifically for tanker ballast water cleaning are excluded.

[from Government Reports Announcements 77(23):#NTIS/PS-77/0750/8GA. 1977]

H. MISCELLANEOUS

C-0695-78
EPA KEEPS TANK CLEAR
Anon. 1977.
Water & Wastes Engineering 14(5):74-75.

Equipment, EPA, *OHMSETT facility

In order to keep the huge EPA Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) clear for testing oil-spill cleanup devices, the facility has installed a sodium hypochlorite generating system. Technical specifications of the system are briefly reviewed.

C-0696-78
BIOGENIC HYDROCARBONS AND PETROLEUM FRACTIONS
Bocard, C., C. Gatellier, N. Petroff, P. Renault, and J. C. Roussel. 1977.
Rapports et Procès-Verbaux des Reunions. International Council for the Exploration of the Sea. Vol. 171:91-93. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Hydrocarbons, Chemical analysis, *Biogenic vs. petroleum

"Knowledge of the differences between biogenic hydrocarbons and those from petroleum is reviewed, and the problems of making this differentiation are discussed. The value of ^{14}C techniques in some cases is considered."

C-0697-78
BIOLOGICAL MONITORING OF WATER AND EFFLUENT QUALITY
Cairns, J., Jr., K. L. Dickson, and G. F. Westlake. 1975.
Philadelphia, American Society for Testing and Materials, 1976. 246p. Symposium, Blacksburg, VA., November 2-4, 1975. ASTM Special Technical Publication, No. 607.

Monitoring, Water quality, *Bio-indicator

"Discussions focus on industrial biological monitoring, research related to evaluation of complex wastes, automated monitoring systems and methods for hypothesis testing and analysis with biological monitoring data." Some of the biological indicators mentioned are trout, fingernail clam (Musculium transversum), and diatoms.

[from Biological Abstracts 64(8):#44691. 1977]

C-0698-78
POLYNUCLEAR AROMATIC CARCINOGENS
Dipple, A. 1976.
ACS Monograph 173 (Chemical Carcinogenesis):245-314.

Carcinogens, PAH, Chemical analysis

"A review with 277 references."

[from Chemical Abstracts 86(7):#38113c. 1977]

C-0699-78
STUDIES ON SOME BIOCHEMICAL INDICES OF PHENOL DEGRADATION BY BACTERIUM ALBUM
Divavin, I. A., K. K. Ermolaev, and O. G. Mironov. 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:126-128. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Chemical effects, Microorganisms, Bacteria, Metabolism, Biological effects, *Bacterium album, *Phenol

Bacterium album are the main consumers of hydrocarbons in the sea. These heterotrophic microorganisms were studied during phenol degradation to determine changes in cellular proteins, lipids, nucleotides, and nucleic acids. Observed was a decrease in total cell protein, and some increase in total cell lipid when the organism was growing on phenol. RNA level more than doubled and nucleic acids and free nucleotides also increased.

C-0700-78
TRACE SULFUR DETERMINATION IN PETROLEUM FRACTIONS
Drushel, H. V. 1978.
Analytical Chemistry 50(1):76-81.

Chemical analysis, Detection, Hydrocarbons, *Sulfur determination

A procedure for determination of sulfur below 1 ppm in light petroleum fractions is described. Noncatalytic hydrogenolysis of the sample at high temperature forms H_2S which is monitored by a Houston Atlas H_2S Analyzer. Long term precision (2 std. dev.) is ±12%, relative, at the 1 ppm sulfur level, and accuracy is estimated as ±10%.

C-0701-78

CYANIDE REMOVAL FROM PETROLEUM REFINERY WASTEWATER USING POWDERED ACTIVATED CARBON
Huff, J. E., and J. M. Bigger. 1977.
Report IIEQ-77-08. 109p. Final report for September 1975 - February 1977.

Wastewater treatment, Refineries, Pollution prevention, *Cyanide removal, *Powdered activated carbon

"This research was initiated to investigate the feasibility of using powdered activated carbon (PAC) and cupric chloride for removal of cyanide in refinery wastewaters."

[from Government Reports Announcements 77(23):#PB-270 862/6GA. 1977]

C-0702-78

STRENGTHENING INDUSTRY'S ROLE IN MARINE INVESTIGATIONS
Miller, G. R. 1975.
Industry Solutions '75: Air-Water-Noise-Solid Waste. Pollution Control Conference of the Water and Wastewater Equipment Manufacturers Association, 3rd, 1975. W. Langworthy (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers, 1975. p. 193-204.

Industries, Pollution control, Wastewaters, Equipment

Summary not available.

[from Bioresearch Index 12(4):#29362. 1976]

C-0703-78

ON THE ORIGIN OF HYDROCARBONS IN MARINE ORGANISMS
Murray, J., A. B. Thomson, A. Stagg, R. Hardy, *et al.* 1977.
Rapports et Procès-Verbaux des Réunions. International Council for the Exploration of the Sea. Vol. 171:84-90. Petroleum Hydrocarbons in the Marine Environment. A. D. McIntyre, and K. J. Whittle (eds.).

Hydrocarbons, Algae, Zooplankton, Biomass, Food web, *Biogenic origin

"Using radiochemical techniques a study has been made of the aliphatic hydrocarbons of certain algae and also of a mixed zooplankton culture which had been allowed to graze on ^{14}C labelled *Phaeodactylum*. In each case only a small number of specific compounds in the alkane array were labelled. The much wider range of hydrocarbons found in harvested marine mixed plankton samples suggests that some of this hydrocarbon may be of exogenous origin."

C-0704-78
MASSIVE DEPOSITION OF MINERAL OIL AFTER PROLONGED INGESTION
Nochomovitz, L. E., et al. 1975.
South African Medical Journal 49(33):2187-2190.

Health hazards, Biological effects, *Mineral oil

Summary not available.

[from Toxicity Bibliography 9(2):#3833. 1976]

C-0705-78
A FUNDAMENTAL STUDY OF THE REMOVAL OF POLYNUCLEAR AROMATIC HYDROCARBONS FROM WATER DURING CHLORINATION
Perry, R., and R. M. Harrison. 1977.
Progress in Water Technology 9(1):103-112.

Water quality, PAH, Health hazards, Extraction, Carcinogens, *Chlorination

"A detailed study has been undertaken of the effects of chlorination upon the removal of polunuclear aromatic hydrocarbons (PAH) from water. Attention has been given to the extraction procedure used prior to the analysis for PAH and to the kinetics of the chlorination process. Significant reductions of PAH have been demonstrated through a water treatment process and these have been investigated at the chlorination stage in relation to temperature, contact time and pH."

C-0706-78
ECOLOGY, NATURAL RESOURCES AND POLLUTION
Santos, M. A. 1975.
New York, Living Books, 1975. 106p.

Ecosystems, Resource management, Industries

Summary not available.

[from Environmental Conservation 3(2):159. 1976]

C-0707-78
GOVERNMENTS RESPONSIBILITIES VS INDUSTRIES POLLUTION PROBLEMS
Schaffer, R. B. 1975.
Industry Solutions '75: Air-Water-Noise-Solid Waste. Pollution Control Conference of the Water and Wastewater Equipment Manufacturers Association, 3rd, 1975. W. Langworthy (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers, 1975. p. 3-13.

Industries, Pollution control, Regulations, Government agencies

Summary not available.

[from Bioresearch Index 12(4):#29354. 1976]

C-0708-78
SEA ICE TOPOGRAPHY IN THE BEAUFORT SEA AND ITS EFFECT ON OIL CONTAINMENT
Wadhams, P. 1976.
AIDJEX Bulletin No. 33. p. 1-52.

Ice, *Topography, Spill containment, Beaufort Sea

Summary not available.

[from Underwater Information Bulletin 9(2):#7704/1301. 1977]

C-0709-78
POLLUTION SUSCEPTIBILITY - AN ENVIRONMENTAL PARAMETER FOR COASTAL ZONE MANAGEMENT
Weyl, P. K. 1976.
Coastal Zone Management Journal 2(4):327-343.

Models, Statistical analysis, Pollution prevention, Resource management, Physical effects, Coasts, *Pollution susceptibility

Pollution susceptibility is a quantitative measure of the tidal flushing of coastal waters that can be determined from data on tidal height and currents. This paper may be applicable to oil pollution research.

[from International Aerospace Abstracts 17(20):#A77-43700. 1977]

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information, and a summary of project objectives are provided in each entry. Project notices have been obtained from: the Smithsonian Science Information Exchange (SSIE); API Annual Report on Research Projects; Marine Research Information Service Abstracts; Scientific and Technical Aerospace Reports; Department of Environment, Canada, Spill Technology Newsletter; Northwest and Alaska Fisheries Center Monthly Report; and written inquiries to organizations and researchers. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered sequentially with a citation number R- -78. Some of the projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted with a current serial number, followed by the original number in parentheses. To locate the original entry, refer to the following list:

Citation Numbers	Dates Covered	Report Number
R-001-74 to R-165-74	July 74 - Oct. 74	EPA-670/2-75-003
R-166-74 to R-244-74	Nov. 74 - Feb. 75	EPA-670/2-75-044
R-245-74 to R-268-74	Feb. 75 - Apr. 75	EPA-670/2-75-059
R-269-74 to R-342-74	May 75 - July 75	EPA-600/2-76-129
R-269-75 to R-304-75	Aug. 75 - Oct. 75	EPA-600/2-76-113
R-001-76 to R-035-76	Nov. 75 - Jan. 76	EPA-600/2-76-185
R-036-76 to R-063-76	Feb. 76 - Apr. 76	EPA-600/2-76-215
R-064-76 to R-123-76	May 76 - July 76	EPA-600/2-76-266
R-124-76 to R-175-76	Aug. 76 - Oct. 76	EPA-600/2-77-037
R-001-77 to R-022-77	Nov. 76 - Jan. 77	EPA-600/2-77-075
R-023-77 to R-039-77	Feb. 66 - Apr. 77	EPA-600/2-77-111
R-040-77 to R-075-77	May 77 - July 77	EPA-600/2-77-243
R-076-77 to R-096-77	Aug. 77 - Oct. 77	EPA-600/2-78-005
R-001-78 to R-020-78	Nov. 77 - Jan. 78	Submitted to EPA 2/78

A. OIL POLLUTION DETECTION AND EVALUATION

1. MONITORING

R-021-78

METHODS MANUAL FOR OIL SPILL SOURCE IDENTIFICATION

Principal Investigator:	Gruenfeld, M.
Performing Organization:	US Environmental Protection Agency, Industrial Environmental Research Lab., 5555 Ridge Ave., Cincinnati, OH 45268
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. No. B623C-275
Period:	10/76 - 9/77
Funds:	$18,000 FY 77

Monitoring, Manuals, Analytical techniques, Source identification, Oil spills, EPA

"The objective of this project is to develop a comprehensive manual of proven analytical methods for the quantitation, characterization, and source identification of petroleum oils that are spilled into the environment."

[SSIE No. ZMA-1355]

R-022-78

FIXED STATION BROAD BASED SPILL ALARM SYSTEM

Principal Investigator:	Tuffly, B. L.
Performing Organization:	Rockwell, International Corp., 8900 DeSoto Ave., Canoga Park, CA 91304
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. Contract 68-03-2080; No. B610A-203
Period:	10/76 - 9/77
Funds:	$10,000 FY 77

Monitoring, Detection, Oil spills, US, *Alarm system

An in-stream system is being developed and evaluated to continuously detect the various hazardous materials spilled into US waterways. The system is composed of a number of individual off-the-shelf probes and sensors, each capable of detecting one or more classes of hazardous material. Organic compounds will be detected by a total organic carbon analyzer. A prototype warning system will also be developed.

[SSIE No. GMA-3675]

2. SAMPLING

R-023-78
PRODUCTION OF WATER QUALITY CONTROL SAMPLES FOR THE QA PROGRAM
Principal Investigator: Allen, G. S.
Performing Organization: Sanitary Engineering Labs, Inc.
2982 N. Cleveland Ave., St. Paul,
MN 55113
Supporting Agency: US Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Support Lab.,
26 W. St. Clair St., Cincinnati, OH 45268.
Contract 68-03-2553, No. A621A-35
Period: 10/76 - 9/77
Funds: $236,000 FY 77

Sampling, Water quality, Monitoring, Hydrocarbons , PAH, *Quality control samples

Various types of quality control samples will be produced for the water supply program, the NPDES permit program, and the Water Quality programs, all for the EPA. Some samples will contain oils and grease, and polynuclear aromatics.

[SSIE No. GMA-3809]

Status: This project is in process, with no published reports.

Information source: G. S. Allen, President, Sanitary Engineering
Laboratories, Inc., 1722 Terrace Drive,
Roseville, MN 55113.

3. ANALYSIS

R-024-78
METHOD OF QUANTITATION FOR PETROLEUM OILS IN WATER
Principal Investigator: Gruenfeld, M.
Performing Organization: US Environmental Protection Agency,
Industrial Environmental Research Lab.,
5555 Ridge Ave., Cincinnati, OH 45268
Supporting Agency: US Environmental Protection Agency,
Office of Research & Development,
Industrial Environmental Research Lab.,
Cincinnati, OH 45268. No. B623C-276
Period: 10/76 - 9/77
Funds: $21,000 FY 77

Chemical analysis, Dispersions, Petroleum products, Sampling, *Quantitation

A method is being developed to quantitate petroleum oils that are dispersed in water, or that have separated from water dispersion following sample collection. Procedures will include solvent extraction, adsorption, gas and liquid chromatography, and spectroscopy. Application to a minimum concentration of 1 μg/L (ppb) is desired.

[SSIE No. ZMA-1336]

R-025-78

CHEMICAL STUDIES DIRECTED TOWARDS ECOLOGICAL DAMAGE ASSESSMENT OF PETROLEUM DISCHARGES INTO THE MARINE ENVIRONMENT

Principal Investigator:	Quinn, J. G.
Performing Organization:	University of Rhode Island, School of Oceanography, Administration Bldg., Wakefield, RI 02881
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882. No. R805477-01, P608C-11
Period:	10/76 - 9/77
Funds:	$64,990 FY 77

Chemical analysis, Oil discharges, Acute effects, Chronic effects, Sampling, Seawater, Sediments, Marine organisms, Toxicity

Analytical chemical studies will be conducted in support of ecological damage assessment of acute and chronic discharges of petroleum into the near-shore marine environment. The studies will include: 1) chemical analyses of petroleum compounds in selected sampling of water, sediments, and organisms, using a variety of analytical techniques; 2) development of new methods and modification of current procedures in support of toxicological and field studies; 3) participation with other federal laboratories in developing and intercalibrating standard reference materials and methods for petroleum analysis.

[SSIE No. GMA-4250]

R-026-78

IN SITU POLLUTANT MEASUREMENTS

Principal Investigator:	Wogman, N. A., and H. G. Rieck
Performing Organization:	Battelle Memorial Institute, PO Box 999, Richland, WA 99352
Supporting Agency:	US Energy Research & Development Administration, Division of Biomedical & Environmental Research, 1717 H St. NW, Washington, DC 20545. Contract EY-76-C-06-1830
Period:	10/76 - 9/77

Analytical techniques, Chemical analysis, Petroleum products, Sediments, Seawater, Freshwater, *In situ analysis

Program objectives are to 1) apply some analytical techniques to in situ mapping of marine and freshwater polluted areas; and 2) evaluate "the feasibility of promising technology for in situ analyses." Immediate emphasis is on the analysis of sediment surfaces. Methods are being developed for the analysis of crude oil and petroleum products pollution resulting from coal, oil, oil shale, and coal conversion technologies.

Status: Recent results dealt with analysis of toxic trace elements by x-ray fluorescence techniques.

[SSIE No. ZPE-11589-1]

B. OIL POLLUTION PREVENTION AND CONTROL

1. CLEANUP AND RECOVERY

R-027-78
MULTIAGENCY PROJECT FOR OIL SPILL EQUIPMENT EVALUATION, PHASE I

Principal Investigator:	Ackerman, R.
Performing Organization:	Mason & Hanger-Silas Mason Co., PO Box 156, Leonardo, NJ 07737
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. Contract 68-03-0490; No. B623C-612
Period:	10/76 - 9/77
Funds:	$38,000 FY 77

Skimmers, Spill recovery, EPA, *Testing, *OHMSETT

Four oil skimmers will be evaluated by performance testing at EPA's OHMSETT. Throughput efficiency, oil recovery efficiency, and oil recovery rate will be determined for two oil types under various wave and current conditions.

[SSIE No. GMA-3666]

Status: The program was sponsored by the USCG, EPA, DOE, and US Navy and evaluated the Oil Mop Zero Relative Velocity Skimmer, Cyclonet D-050, Bennett Mark 6E, and CLOWSOR skimmers. A report and a 16 mm movie are in preparation.

Reports and Publications

PERFORMANCE TESTS OF FOUR SELECTED OIL SKIMMERS
Graham, D., and R. Urban. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

Information Source: R. A. Ackerman, General Manager, Mason & Hanger-Silas Mason Co., Inc., PO Box 117, Leonardo, NJ 07737.

R-028-78 (R-278-75)
OPERATE OHMSETT

Principal Investigator:	Ackerman, R., and E. McCracken
Performing Organization:	Mason & Hanger-Silas Mason Co., PO Box 156, Leonardo, NJ 07737
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. Contract 68-03-0490; No. B623C-235

Period: 10/76 - 9/77
Funds: $40,000 FY 77

Spill cleanup, Environmental effects, EPA, *Testing, *OHMSETT

The objective of this project is to provide an operations and maintenance staff and a mechanism for operating the EPA Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility. Funding for this project is provided by various testing programs executed for OHMSETT "customers," who are currently limited to federal, state, and local government agencies.

[SSIE No. GMA-3664]

Status: A brief unpublished annual letter report is provided to the OHMSETT EPA Project Officer for this project. Various activities and projects are summarized, but the report is almost totally maintenance and modification oriented.

However, there are many publications available concerning the OHMSETT technical capabilities, achievements, and testing projects. Therefore a lengthy list is provided here for the convenience of Oil Pollution Reports users.

Reports and Publications

A RIGID, PERFORATED PLATE OIL BOOM FOR HIGH CURRENTS
Ayers, R. R. 1976.
Report EPA-600/2-76-263. Cincinnati, Ohio, US Environmental Protection Agency, 1976. 132 p.

PERFORMANCE TESTING OF OIL MOP ZERO RELATIVE VELOCITY OIL SKIMMER
Breslin, M. K. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

BOOM CONFIGURATION TESTS FOR CALM-WATER, MEDIUM CURRENT SPILL DIVERSION
Breslin, M. K. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

MSORS PERFORMANCE TESTING SUMMARY
Brunner, D. E. 1977.
Report TM-M-54-77-1. Port Hueneme, California, US Navy Civil Engineering Laboratory, 1977. 17 p.

AN OFFSHORE MECHANIZED SORBENT OIL RECOVERY SYSTEM USING VESSELS OF OPPORTUNITY
Brunner, D. E., J. J. Der, and D. Hall. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 251-254.

TESTS OF COAST GUARD DEVELOPED HIGH SEAS OIL RECOVERY SYSTEMS AT EPA OHMSETT
Chang, W. J. 1975.
Report CG-D-101-75. Washington, D.C., US Coast Guard, 1975. 35 p.

AIR JET BOOM FOR CONTROL OF FLOATING SPILLS
Cohen, S. H. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

A DISTRIBUTED REUSABLE-SORBENT OIL RECOVERY SYSTEM
Dorrler, J. S., and S. H. Shaw. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 247-250.

OHMSETT ACHIEVEMENTS
Farlow, J. S. 1978.
Edison, New Jersey, US Environmental Protection Agency, Research & Development, IERL-Ci. 13 p.

Test programs to evaluate and improve methods of spill control and removal are sponsored by the US EPA, Coast Guard, Navy, Army, and DOE at the OHMSETT facility. This brochure describes the numerous programs completed through March 1978.

OHMSETT CAPABILITY
Farlow, J. S. 1978.
Edison, New Jersey, US Environmental Protection Agency, Research & Development, IERL-Ci. 18 p.

"This summary for potential users describes the OHMSETT technical capabilities for performance evaluation of spill control systems. Additional details are available in the OHMSETT Standard Operating Procedures Manual."

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY'S TEST FACILITY OHMSETT: THE FIRST SIX MONTHS
Farlow, J. S., and F. J. Freestone. 1975.
Proceedings of the 1975 Conference on Prevention and Control of Oil Pollution. San Francisco, California, American Petroleum Institute, 1975. p. 343-345.

DEVELOPMENT OF A HIGH CURRENT OIL BOOM/SKIMMER
Folsom, B. A. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

DEVELOPMENT OF A HIGH CURRENT STREAM-LINED OIL BOOM/SKIMMER FOR INLAND WATERWAYS
Folsom, B. A., and C. Johnson. 1977.
Proceedings of the 1977 Oil Spill Conference, New Orleans, Louisiana, American Petroleum Institute, 1977. p. 323-327.

PERFORMANCE TESTS OF THREE FAST CURRENT OIL RECOVERY DEVICES
Getman, J. H. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 341-346.

PERFORMANCE TESTS OF FOUR SELECTED OIL SKIMMERS
Graham, D., and R. Urban. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

EVALUATION OF A PASSIVE MICROWAVE TECHNIQUE FOR THE MEASUREMENT OF OIL FILM THICKNESS IN A TEST TANK ENVIRONMENT
Hollinger, J. P., and J. E. Kenney. 1976.
NRL Report 3308. Washington, D.C., US Naval Research Laboratory, 1976. 48 p.

PERFORMANCE TESTING OF THREE OFFSHORE SKIMMING DEVICES
Lichte, H. W., and M. K. Breslin. 1978.
Washington, D.C., US Department of Energy, 1978 (in press).

TESTING SKIMMERS FOR OFFSHORE SPILLED OILS
Lichte, H. W., and M. K. Breslin. 1978.
Proceedings of the 1978 Offshore Technology Conference, Houston, Texas, 1978.

HYDRODYNAMICS OF A DIVERSIONARY BOOM
McCracken, W. E. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

PERFORMANCE TESTING OF THE TETRADYNE HIGH SPEED AIR JET SKIMMER
McCracken, W. E., and S. H. Schwartz. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

PERFORMANCE TESTING OF SELECTED INLAND OIL SPILL CONTROL EQUIPMENT
McCracken, W. E. 1977.
Report EPA-600/2-77-150. Cincinnati, Ohio, US Environmental Protection Agency, 1977. 113 p.

HYDRODYNAMICS OF A DIVERSIONARY BOOM
McCracken, W. E., and F. J. Freestone. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 329-334.

COMBINED SKIMMER-BARRIER HIGH SEAS OIL RECOVERY SYSTEM
Milgram, J. H., and R. A. Griffiths. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 375-379.

USN DIP 3001 PERFORMANCE TEST PROGRAM
Nadeau, P. F. 1976.
Alexandria, Virginia, US Naval Facilities Engineering Command, 1976. 23 p.

DEBRIS HANDLING SYSTEM FOR NAVY HARBOR OIL SPILL CLEANUP OPERATIONS
Nadeau, P. F. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 271-275.

A ONE-HUNDRED-TON OIL RECOVERY VESSEL FOR BANTRY BAY
Neal, R. W., and R. A. Bianchi. 1977.
Proceedings of the 1977 Offshore Technology Conference, Houston, Texas, 1977. p. 269-282.

DEVELOPMENT OF A SORBENT DISTRIBUTION AND RECOVERY SYSTEM
Shaw, S. H., R. P. Bishop, and R. J. Powers. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

TECHNIQUES FOR MIXING DISPERSANT-TREATED OIL SLICKS INTO THE WATER
Smith, G. F., and W. E. McCracken. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 403-406.

PERFORMANCE TESTING OF SELECTED SORBENT BOOMS
Smith, G. F. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

OHMSETT HIGH SEAS PERFORMANCE TESTING: MARCO CLASS V OIL SKIMMER
Smith G. F., and W. E. McCracken. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

TECHNIQUES FOR MIXING DISPERSANTS WITH SPILLS
Smith, G. F., and W. E. McCracken. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in preparation).

PERFORMANCE TESTS OF THREE SKIMMERS AND ONE BOOM AT OHMSETT
Widawsky, A. 1976.
Report TM-60P-76-11. Port Hueneme, California, US Navy Civil Engineering Laboratory, 1976. 138 p.

SURFACE ENHANCEMENT--BRINGING IT ALL TOGETHER
Wilson, J. E. 1977.
Proceedings of the 1977 Oil Spill Conference. New Orleans, Louisiana, American Petroleum Institute, 1977. p. 347-354.

Information source: R. Ackerman, Mason & Hanger-Silas Mason Co., Inc.,
PO Box 117, Leonardo, NJ 07737.

R-029-78

PERFORMANCE TESTING OFFSHORE EQUIPMENT

Principal Investigator:	Ackerman, R.
Performing Organization:	Mason & Hanger-Silas Mason Co., 200 W. Vine St., Lexington, KY 40507
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. Contract 68-03-0490; No. B623C-246
Period:	10/76 - 9/77
Funds:	$132,000 FY 77

Skimmers, Spill cleanup, EPA, *Testing, *OHMSETT

Performance evaluations are being prepared for two oil skimmers (MARCO Class V and a prototype Oil Mop, Inc. ZRV) and a research prototype sorbent system: the Mechanized Sorbent Oil Recovery System (MSORS) developed by the Navy Civil Engineering Laboratory (CEL). Controlled reproducible tests are being conducted at EPA's OHMSETT facility.

[SSIE No. GMA-3665]

Reports and Publications

OHMSETT HIGH SEAS PERFORMANCE TESTING: MARCO CLASS V OIL SKIMMER
Smith, G. F., and W. E. McCracken. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

PERFORMANCE TESTING OF OIL MOP ZERO RELATIVE VELOCITY OIL SKIMMER
Breslin, M. K. 1978.
Cincinnati, Ohio, US Environmental Protection Agency, 1978 (in press).

MSORS PERFORMANCE TESTING SUMMARY
Brunner, D. E. 1977.
Report TM-M-54-77-1. Port Hueneme, California, US Navy Civil Engineering Laboratory, 1977. 17 p.

AN OFFSHORE MECHANIZED SORBENT OIL RECOVERY SYSTEM USING VESSELS OF OPPORTUNITY
Brunner, D. E., J. J. Der, and D. Hall. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 251-254. (American Petroleum Institute No. 4284.)

Information source: R. A. Ackerman, General Manager, Mason & Hanger-Silas Mason Co., Inc., PO Box 117, Leonardo, NJ 07737.

R-030-78

NEW AMINE CARBAMATE GELATION TECHNIQUES FOR USE IN OIL SPILL RECOVERY OPERATIONS

Principal Investigator: Bannister, W. W.
Performing Organization: University of Lowell, School of Pure & Applied Sciences, Lowell, MA 01854
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. No. R804628-01, B623C-602
Period: 10/76 - 9/77
Funds: $29,000 FY 77

Spill recovery, Oceans, Freshwater, Pollution prevention, *Amine carbamate gelation techniques

"The main objective of this research is to develop for 'real world' situations an amine carbamate gelation technique to facilitate the removal of petroleum derived oil spilled on ocean or inland waters."

[SSIE No. GMA-3739]

R-031-78

PROTECTION AND RESTORATION OF SHORELINES FROM OIL SPILLS

Principal Investigator: Castle, R.
Performing Organization: U R S Research Co., 155 Bovet Rd., San Mateo, CA 94402
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. No. 68-03-2160, B623C-287
Period: 10/76 - 9/77
Funds: $12,000 FY 77

Manuals, Spill cleanup, Shorelines, Environmental protection, Restoration, Equipment, *Field methods

This project will compile Manuals of Practice on spill containment, dispersal, and removal in order to minimize damage to shorelines from oil and hazardous substance discharges. Field relevant methods and techniques will be evaluated and selected from the currently practiced state-of-the-art. Appendixes will include field procedures for using existing products, equipment, and supplies.

[SSIE No. GMA-3686]

2. OIL TRANSFER AND TRANSPORT

R-032-78
OFFSHORE PIPELINES
Principal Investigator: Herbich, J. B.
Performing Organization: Texas A&M University, Department of Civil Engineering, College Station, TX 77843
Supporting Agency: National Oceanic and Atmospheric Administration, Department of Commerce, Washington, DC 20230. No. SP-1
Period: 1/76 - 12/76

Pipelines, Offshore development, Design-engineering, Pollution prevention

Objectives include: 1) determining the dominant parameters which affect pipeline dynamics and stability; and 2) developing new or improved design criteria to minimize the high failure rate of offshore pipelines.

[from Maritime Research Information Service Abstracts Vol. 15:#15 141176. 1977.]

R-033-78
HYDROLOGIC PROBLEMS RELATED TO CONSTRUCTION OF THE TRANS-ALASKA PIPELINE SYSTEM
Principal Investigator: Sloan, C. E.
Performing Organization: US Department of the Interior, Geological Survey, 1209 Orca St., Anchorage, AK 99501
Supporting Agency: US Department of the Interior, Geological Survey, Water Resources Division, 12201 Sunrise Valley Dr., Reston, VA 22092 No. AK 76-100
Period: 7/75 - 9/76
Funds: $74,534 FY 76

Pipelines, Water quality, Monitoring, Streams, Fish, Biological effects, Alaska, *TAPS

Hydrologic impacts of the construction and operation of the Trans-Alaska Pipeline System (TAPS) will be quantitatively determined. Long- and short-term effects are being monitored through field data collection and water quality analyses. Field sites include streams affected by oil spills and a spawning stream rehabilitation area. Water quality analysis at pipeline stream crossings did not show any long-term adverse effects resulting from pipeline construction.

[SSIE No. ZUA-4007]

Status: This project is now complete. There were no published reports resulting from the study.

Information Source: Charles Sloan, USGS, WRD,
218 E St., Anchorage, AK 99501

3. WASTE TREATMENT AND DISPOSAL METHODS

R-034-78

EFFECTIVENESS AND COST OF ACTIVATED CARBON ADSORPTION OF TOXIC COMPOUNDS FROM PETROLEUM REFINERY WASTEWATERS

Principal Investigator: Burks, S. L.
Performing Organization: Oklahoma State University, Reservoir Research Center, Life Sciences W., Stillwater, OK 74074
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Robert S. Kerr Environmental Research Lab., PO Box 1198, Ada, OK 74820. No. R805307-01, L610C-20
Period: 10/77 - 9/78

Wastewater treatment, Refineries, Adsorption, Toxicity, *Activated carbon, *Bioassay

"A study will be conducted to determine the adsorption capacity of activated carbon for specific toxic organic compounds identified in petroleum refinery wastewaters. . . . In addition, Fathead minnow and benthic macroinvertebrate continuous-flow bioassays of carbon treated petroleum refinery wastewaters will be performed to determine the capability of carbon treatment to produce a 'zero-toxic-pollutant' discharge."

[SSIE No. GMA-3849]

Status: No reports have been published as of March 1978.

Information source: S. L. Burks, Reservoir Research Center,
Life Sciences West 427, Oklahoma State
University, Stillwater, OK 74074

R-035-78

IDENTIFY ORGANICS IN PETROLEUM REFINERY WASTEWATERS

Principal Investigator: Garrison, A. W.
Performing Organization: US Environmental Protection Agency, Environmental Research Lab., College Station Rd., Athens, GA 30601
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., College Station Rd., Athens, GA 30601. No. K713B-135

Period: 10/76 - 9/77
Funds: $13,000 FY 77

Wastewater treatment, Refineries, Chemical Analysis, *GC/MS

"Extracts from a typical refinery wastewater will be examined by gas chromatography/mass spectrometry to identify the compounds being discharged. Sampling points include the API separator effluent, Pasveer Ditch effluent, and final lagoon effluent. Tentative identification of classes of compounds and some specific compounds will be available from EPA Grant R803019-01 and confirmations and quantitation of some of these will be attempted."

[SSIE No. ZMA-1121]

R-036-78
TRUCK WASHING TERMINAL WATER POLLUTION CONTROL
Principal Investigator: O'Brien, J. E.
Performing Organization: Matlack Incorporated, 10 W. Baltimore Ave., Lansdowne, PA 19050
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. No. S803656-01, B610B-049
Period: 10/76 - 9/77
Funds: $15,000 FY 77

Wastewater treatment, Oil tanks, Economics, Reuse, Reclamation, Toxicity, *Tank truck washing

"This project will demonstrate in full scale a physical/chemical/biological treatment process for the treatment of wastewaters generated during the internal washing of tank trucks." The economics and effectiveness of sedimentation, air flotation, filtration, carbon adsorption, and biological treatment will be determined. Reuse of treated wastewater, reclamation of oily fractions as fuel, and toxic hazards will also be studied.

[SSIE No. GMA-3745]

4. OIL-WATER SEPARATION

R-037-78
REVIEW AND ANALYSIS OF OIL/WATER SEPARATION LITERATURE
Principal Investigator: Ahlert, R. C.
Performing Organization: Rutgers, The State University, School of Engineering, New Brunswick, NJ 08903

Supporting Agency: US Environmental Protection Agency,
Office of Research & Development,
Industrial Environmental Research Lab.,
Research Triangle Park, NC 27711.
No. R803978-01, B623C-271
Period: 10/76 - 9/77
Funds: $10,000 FY 77

Oil-water separation, Design-engineering, Equipment, *Review

"The project will identify, organize and interpret technical and commercial literature resources on oil/water separation. Detailed information on design consideration and operating characteristics of systems, devices and processes will be assembled."

[SSIE No. GMA-3750]

5. PERSONNEL TRAINING AND EDUCATION

R-038-78
TANKER ADVISORY CENTER
Principal Investigator: McKenzie, A.
Performing Organization: Tanker Advisory Center, 10 East End Ave., New York, NY 10021
Supporting Agency: Tanker Advisory Center
Period: 2/74 - 9/78

Personnel training, Tankers, Information systems, Statistics, *Tanker casualties, *Computer services

The Tanker Advisory Center offers varied tanker information and services, useful for increasing operating efficiency, improving safety performance, and responding constructively to changing tanker requirements. The Tanker Index consists of files of every one of the more than 5000 seagoing tankers, ore/oil, and bulk/oil carriers of over 6,000 dwt, and all liquid gas carriers in existence. The files go back to January 1964 and are updated daily. Other services include: 1) tanker reports prepared on individual tankers or on selected fleets or types of tankers; 2) computer services: all information in the Tanker Index is stored in the General Electric Time-Sharing Computer; 3) in-depth studies and analyses of tanker casualties are prepared, reflecting operational variables; 4) sale prices and charter rates are posted; 5) the Director of the Tanker Advisory Center, Mr. Arthur McKenzie, is available as a consultant; and 6) tanker operation classes are offered.

[from Maritime Research Information Service Abstracts Vol. 15:#09 057540. 1977]

Reports and Publications

WORLDWIDE TANKER CASUALTY RETURNS 1977
Tanker Advisory Center. 1978.
New York, Tanker Advisory Center, 1978. 2 p. Newsletter, March 31, 1978.

This Newsletter is the latest quarterly report. All casualty data were obtained from Lloyd's List, and are tabulated for casualty frequency, and distribution of tanker casualties by size, age, and flag. Oil spills increased in 1977 both in numbers of incidents and the total quantity spilled.

TANKER ADVISORY CENTER
Tanker Advisory Center. 1978.
New York, Tanker Advisory Center, 1978. 5 p.

This latest brochure (second revision, January 1978), explains the functions of the Center.

Information source: Arthur McKenzie, Tanker Advisory Center, Inc.,
10 East End Ave., New York, NY 10021

6. PREVENTION AND CONTROL MEASURES

R-039-78
PETROLEUM PIPELINE LEAK DETECTION

Principal Investigator:	Burghart, G. H.
Performing Organization:	Science Applications, Inc., 1200 Prospect St., La Jolla, CA 92037
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab., Cincinnati, OH 45268. Contract 68-03-2532; No. B623C-298
Period:	10/76 - 9/77
Funds:	$110,000 FY 77

Detection, Leakage, Pipelines, Design-engineering, Inland, Environmental protection, Offshore development

Project objectives are 1) to define the state-of-the-art of pipeline leak detection, and 2) to develop improved techniques to advance this area of technology to minimize environmental impacts. Current conditions make this research quite necessary. A large percentage of inland oil spills are due to pipeline failures, and new OCS development produces more oil transport through pipelines. Present leak detection methods permit large quantities of material to flow from the pipe prior to shutdown.

[SSIE No. GMA-3668]

C. ASPECTS OF OIL POLLUTION

1. BIOLOGICAL ASPECTS

R-040-78

SUBLETHAL EFFECTS OF OIL ON BEHAVIOR AND CHEMICAL SENSES OF MARINE ANIMALS

Principal Investigator:	Atema, J.
Performing Organization:	Boston University, School of Liberal Arts, 755 Commonwealth Ave., Boston, MA 02215
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., S. Ferry Rd., Narragansett, RI 02882. No. R803833-03, P608C-6
Period:	10/76 - 9/77
Funds:	$57,000 FY 77

Hydrocarbons, Behavior, Marine organisms, Sublethal effects, Fuel oil, Chronic effects, *Chemoreception

The objective of this research is to determine if and how petroleum hydrocarbons affect chemoreception and chemically-stimulated behavior in marine animals. Studies will concern chemoreception and behavior of lobsters exposed to No. 2 fuel oil and different hydrocarbon fractions; and chronic effects of oil spills on field populations along Buzzards Bay, Massachusetts. Methods include behavioral and neurophysiological bioassays, flow-through oil dosing, and chemical monitoring of exposure levels.

Status: It has been found that low sublethal levels of No. 2 fuel oil (Water Accommodated Fraction) interfere with lobster feeding behavior, and that oil acts as a chemical stimulus on distance chemoreceptors.

[SSIE No. GMA-4253]

Reports and Publications

LOBSTER BEHAVIOR AND CHEMORECEPTION: SUBLETHAL EFFECTS OF NUMBER 2 FUEL OIL
Atema, J., E. B. Karnofsky, and S. Oleszko-Szuts. 1978. State of Marine Environmental Research. F. Jacoff (ed.). Govt. Printing Office. Proceedings of a Symposium (in press).

Lobsters (Homarus americanus) were exposed to the water-accommodated fraction of #2 fuel oil in a flow-through oil dosing system. Exposure for 5 days to 0.08 and 0.15 ppm caused significant delays in feeding but it remains to be proven that low level exposure effects are due to chemoreception interference by oil. Exposure to 1.5 ppm caused severe neuromuscular defects within 24 hrs.

THE EFFECTS OF OIL ON LOBSTERS
Atema, J. 1977.
Oceanus 20(4):67-73.

Petroleum pollution can be very toxic to the Maine lobster _Homarus americanus_. It can reduce the population as well as contaminate those used for human consumption. Study shows lobsters react in abnormal ways when exposed to hydrocarbons of varying intensities. Several types of oil were used to test reactions, which ranged from normal to spastic motor movements to death.

SUBLETHAL EFFECTS OF PETROLEUM FRACTIONS ON THE BEHAVIOR OF THE LOBSTER, _HOMARUS AMERICANUS_, AND THE MUD SNAIL, _NASSARIUS OBSOLETUS_
Atema, J. 1976.
Estuarine Processes. M. Wiley (ed.). New York, Academic Press, 1976. Vol. 1:302-312. Proceedings of the 3rd International Estuarine Research Conference, held in 1975.

Behavioral effects of kerosene, No. 2 fuel oil, crude oil, and water soluble fractions of each on the title organisms were studied. Certain hydrocarbon fractions, especially branched-cyclic, polar aromatic and soluble hydrocarbons in specific amounts appear to cause distinct behavioral changes.

Information source: J. Atema, Boston University Marine Program, Marine Biological Laboratory, Woods Hole, MA 02543

R-041-78
EFFECTS OF DRILLING FLUIDS AND OIL IN CORALS OCCUPYING HARD-BANK COMMUNITIES

Principal Investigator:	Bright, T. J.
Performing Organization:	Texas A&M University System, School of Geosciences, College Station, TX 77843
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab, Sabine Island, Gulf Breeze, FL 32561. No. R805441-01, Q625F-1-5
Period:	10/76 - 9/77
Funds:	$22,561 FY 77

Biological effects, Oil shale, *Drilling fluids, Corals, Behavior, Metabolism, Mexico/Gulf of

The behavioral and physiological reactions of scleractinian corals indigenous to hard bank communities in the Gulf of Mexico will be determined in response to chronic low levels of drilling fluid components and shale oil products. Time-lapse-macrophotographic and respirometric techniques will be used to measure the response parameters. Exposure to contaminants will be in "flow through" aquaria on board a platform 12 mi offshore of Panama City.

[SSIE No. GMA-4121]

Status: This project is in its first year. A report is due to EPA on May 15, 1978.

Information source: T. J. Bright, Department of Oceanography, College of Geosciences, Texas A&M University, College Station, TX 77843

R-042-78
ECOSYSTEM STABILITY
Principal Investigator: Harte, J., D. Levy, A. Jassby, E. Lapan, and J. Rees
Performing Organization: University of California, Lawrence Berkeley Laboratory, Berkeley, CA 94720
Supporting Agency: US Energy Research & Development Administration, Division of Biomedical & Environmental Research, 1717 H St. NW, Washington, DC 20545
Period: 10/76 - 9/77

Biological effects, Ecosystems, Freshwater, Oil slicks, Microorganisms, Biodegradation, *Stability

This project will examine the response of laboratory freshwater microorganisms to specific energy-related stresses and assess the validity of various possible predictive stability indicators. The impacts of petroleum surface films on net primary productivity, respiration, trophic structure, and chemical composition will be examined. Manipulations such as nutrient additions will be studied as they affect enhancement of biodegradation. Theoretical studies of ecosystem stability properties will also be studied.

Status: The practicality of aquatic microorganisms as a research tool for studying ecological response to stress has been demonstrated. Laboratory modifications have been made based on specific similarities and differences discovered in natural systems.

[SSIE No. ZPE-12198]

R-043-78
CONSEQUENCES OF CRUDE OIL CONTAMINATION ON COLD CLIMATE SALT MARSHES AND INSHORE ECOSYSTEMS - PHASE I - FIELD SITE RECONNAISSANCE
Principal Investigator: McRoy, C. P.
Performing Organization: University of Alaska, Institute of Marine Science, Fairbanks, AK 99701

Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 S.W. 35th St., Corvallis, OR 97330. No. R805668-01, M608C-42.
Period:	10/76 - 9/77
Funds:	$34,966 FY 77

Crude oil, Contamination, Marshes, Ecosystems, Alaska, Baseline studies

Crucial field sites will be selected for research on the consequences of crude oil contamination on salt marshes and related ecosystems in Alaskan waters. A preliminary analysis will be conducted of the biotic community structure, nutrient cycling, and primary productivity. This project will form the basis for more extensive research to study the effects of crude oil contamination on marshes.

[SSIE No. GMA-4228]

Status: The major field effort for this project will be in Spring 1978. There are no publications to date.

Information source: C. Peter McRoy, Institute of Marine Science,
University of Alaska, Fairbanks, AK 99701

R-044-78

EFFECTS OF CADMIUM, POLYCHLORINATE AND BIPHENYL CHLORINATED NAPHTHALENE ON MOLLUSKS FROM THE GULF OF MEXICO

Principal Investigator:	Neff, J. M.
Performing Organization:	Texas A&M University System, School of Science, College Station, TX 77843
Supporting Agency:	US National Science Foundation, Division of Ocean Sciences, 1800 G St. NW, Washington, DC 20550. No. OCE75-04890 A01
Period:	1/78 - 12/78
Funds:	$37,040 FY 78

Hydrocarbons , Toxicity, Marine organisms, Biological effects, Oceans, *Bio-indicators

"The Biological Effects Program (BEP) is conducting laboratory studies to evaluate the effects of metals, petroleum, chlorinated hydrocarbons and phthalates on marine organisms. The objectives of this program are to determine which species, life cycle stages and physiological processes are most affected by various types of pollutants, and at what levels. In addition, the investigators are looking specifically for biological indicators which could be used as an early warning system to detect pollutant-induced perturbations in the open ocean."

[SSIE No. GSN-1816-3]

R-045-78

LETHAL AND SUBLETHAL EFFECTS ON SELECTED ALASKAN MARINE SPECIES AFTER ACUTE AND LONG-TERM EXPOSURE TO OIL AND OIL COMPONENTS

Principal Investigator:	Rice, S. D., S. Korn, and J. F. Karinen
Performing Organization:	Auke Bay Fisheries Laboratory, National Marine Fisheries Service, PO Box 155, Auke Bay, AK 99821
Supporting Agency:	[Outer Continental Shelf Energy Assessment Program - sponsored by:] US Department of Interior, Bureau of Land Management. Contract #R7120822, Research Unit #72
Period:	10/77 - 9/78
Funds:	$300,000 FY 78

Petroleum products, Toxicity, Mortality, Sublethal effects, Marine organisms, Acute effects, Chronic effects, Alaska

Physiological and bioassay tests of applied research on species indigenous to the Gulf of Alaska, Bering Sea, and Beaufort Sea are being conducted. Included are: 1) toxicity experiments for the identification of sensitive species, life stages, factors that affect toxicity, and components most responsible for toxicity; and 2) sublethal physiological response experiments for the identification, measurement, and characterization of physiological responses indicative of oil stress.

Status: OCSEAP funding for this project began in FY 75 and will continue through at least FY 78. Implications of this research include: 1) oil effects and organism responses to oil are complex, species dependent, and variably modified by environmental factors; 2) extremely low hydrocarbon concentrations reduce survival of marine organisms; and 3) immediate or delayed death from oil are not the only dangers to species, as behavioral changes may increase mortality levels by predation.

Reports and Publications

EFFECTS OF CRUDE OIL EXPOSURE ON KING CRAB (PARALITHODES CAMTSCHATICA) GILL MORPHOLOGY
Borchek, M. A., and M. M. Babcock. n.d.
In Lab. Review, target journal: Journal of Invertebrate Pathology.

SENSITIVITY OF LARVAL AND ADULT ALASKAN SHRIMP AND CRABS TO ACUTE EXPOSURES OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL
Broderson, C. C., S. D. Rice, J. W. Short, T. A. Mecklenburg, and J. F. Karinen. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 575-578. (American Petroleum Institute No. 4284.)

Tests using 96-hr static bioassays at water temperatures normally encountered by the organisms were conducted in the title study. Larvae were found to be more sensitive to oil than adults, and the sensitivity of the larvae was dependent on species and developmental stage. Greater vulnerability of larvae to oil exposure is probably due to greater susceptibility to oil toxicity and predation. Cold water species are particularly vulnerable because of the long time spent as developing larvae.

THE EFFECTS OF TEMPERATURE ON THE TOXICITY OF COOK INLET CRUDE OIL WATER-SOLUBLE FRACTION TO SCALLOPS, SHRIMP, AND PINK SALMON FRY
Korn, S., S. D. Rice, and D. A. Moles.
Submitted to journal.

MOLTING AND SURVIVAL OF KING CRAB (PARALITHODES CAMTSCHATICA) AND COONSTRIPE SHRIMP (PANDALUS HYPSINOTUS) LARVAE EXPOSED TO COOK INLET CRUDE OIL WATER-SOLUBLE FRACTION
Mecklenburg, T. A., S. D. Rice, and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 221-228. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Molting larvae were more sensitive than intermolt larvae to the WSF of crude oil, and molting coonstripe shrimp larvae were more sensitive than molting king crab larvae. When molting larvae were exposed to high concentrations of the WSF (1.15-1.87 ppm total hydrocarbons) for six hours, molting success was reduced by 10-30% and some deaths occurred. When larvae were exposed to these concentrations for 24 hours or longer, molting declined 90-100% and the larvae usually died. Comparisons of sensitivity to oil between different crustacean species or life stages should be based on animals tested in the same stage of the molt cycle.

ACUTE TOXICITY AND UPTAKE-DEPURATION STUDIES WITH COOK INLET CRUDE OIL, PRUDHOE BAY CRUDE OIL, NO. 2 FUEL OIL AND SEVERAL SUBARCTIC MARINE ORGANISMS
Rice, S. D., J. W. Short, C. C. Brodersen, T. A. Mecklenburg, *et al*. 1976.
Auke Bay, Alaska, Northwest Fisheries Center Auke Bay Fisheries Laboratory, National Marine Fisheries Service, NOAA, 1976. Processed Report. 89 p.

The primary objectives mentioned in the title were carried out with fish and shellfish species found in Kachemak Bay. Methods, results, and specific conclusions are discussed. General conclusions indicate that major differences do not exist between the responses of the Alaskan marine animals tested and the responses of marine animals from other areas as reported in the literature.

EFFECTS OF PETROLEUM HYDROCARBONS ON BREATHING AND COUGHING RATES, AND HYDROCARBON UPTAKE-DEPURATION IN PINK SALMON FRY

Rice, S. D., R. E. Thomas, and J. W. Short. 1977.
Physiological Responses of Marine Biota to Pollutants.
F. J. Vernberg, A. Calabrese, F. P. Thurberg, and W. B. Vernberg (eds.). New York, Academic Press, 1977. p. 259-277.

Breathing and coughing rates of pink salmon fry, *Oncorhynchus gorbuscha*, were monitored during exposure to WSF of Cook Inlet and Prudhoe Bay crude oils and No. 2 fuel oil. High breathing rates during the first 24 hr of exposure, elimination of most aromatics by 20 hr, and the continued high breathing during a contact-dose exposure for 72 hr indicate that salmon fry can cope with a sublethal exposure to hydrocarbons, but at the cost of an increased metabolic rate. Increased metabolic rates may be detrimental to survival if the stress persists for long periods of time.

THE EFFECTS OF PRUDHOE BAY CRUDE OIL ON SURVIVAL AND GROWTH OF EGGS, ALEVINS, AND FRY OF PINK SALMON, *ONCORHYNCHUS GORBUSCHA*

Rice, S. D., D. A. Moles, and J. W. Short. 1975.
Proceedings of the 1975 Conference on the Prevention and Control of Oil Pollution, March 25-27, 1975, San Francisco, California. Washington, D.C., American Petroleum Institute, 1975. p. 503-507.

Standard 96-hr bioassays with "total" oil solutions in fresh water and seawater determined differences in sensitivity of the developing life stages of the title species. In fresh water, the fry were greatly susceptible at the time of emergence (completion of yolk absorption). After fry migration in seawater, susceptibility is even greater.

A REVIEW OF COMPARATIVE OIL TOXICITY AND COMPARATIVE ANIMAL SENSITIVITY

Rice, S. D., J. W. Short, and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 78-94. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

This review includes studies dealing with the ability of crude and refined oils to kill marine animals, and covers: 1) the behavior of oil in water; 2) the methodology problems associated with bioassays; 3) the comparative toxicity of oil-water mixtures, oils, and components of oils; and 4) the comparative sensitivity of different life stages and species.

TOXICITY OF COOK INLET CRUDE OIL AND NO. 2 FUEL OIL TO SEVERAL ALASKAN MARINE FISHES AND INVERTEBRATES

Rice, S. D., J. W. Short, and J. F. Karinen. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 394-406. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Median tolerance levels of 27 different marine Alaskan invertebrate and vertebrate species to WSF of crude oil and No. 2 fuel oil were determined using a 96-hr static bioassay method. The two oils were equally toxic, fish were consistently among the most sensitive species. Alaskan marine species appear to be slightly more sensitive than those of temperate regions; this difference in sensitivity may be due to the greater persistence of toxic hydrocarbons at the lower temperatures.

ACCUMULATION, RETENTION, AND DEPURATION OF PETROLEUM-DERIVED HYDROCARBONS BY FOUR SPECIES OF ALASKAN MARINE ANIMALS (SCALLOPS, SHRIMP, KING CRAB, AND SALMON)
Short, J. W., and S. D. Rice.
Submitted to journal.

COMPARISON OF TWO METHODS FOR OIL AND GREASE DETERMINATION
Short, J. W., S. D. Rice, and D. L. Cheatham. 1976.
Assessment of the Marine Arctic Environment: Selected Topics. D. W. Hood and D. C. Burrell (eds.). Fairbanks, Alaska, University of Alaska, Institute of Marine Science, 1976. p. 451-462. (Occasional Publication No. 4.)

Comparison of a gravimetric method and a spectrophotometric method of determining WSF of crude oil indicates that the gravimetric method is inadequate for anything but grease determination. Infrared spectrophotometry was 100% effective in determining levels of grease, crude oils, and No. 2 fuel oil.

RESPONSE OF THE CLAM, MACOMA BALTHICA (LINNAEUS), EXPOSED TO PRUDHOE BAY CRUDE OIL AS UNMIXED OIL, WATER-SOLUBLE FRACTION, AND OIL-CONTAMINATED SEDIMENT IN THE LABORATORY
Taylor, T. L., and J. F. Karinen. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D. A. Wolfe (ed.). New York, Pergamon Press, 1977. p. 229-237. Proceedings of a Symposium, Seattle, Washington, November 10-12, 1976.

Gentle settling of crude oil over clam beds had negligible effects on clams observed for two months. Water-soluble (WSF) and oil-treated (OTF) sediment fractions of Prudhoe Bay crude oil inhibited burrowing and caused clams to move to the sediment surface. Responses were directly proportional to the concentrations of the WSF or amount of OTF. The significance of these laboratory tests to survival of M. balthica in the natural environment is discussed.

INCREASED OPERCULAR RATES OF PINK SALMON (ONCORHYNCHUS GORBUSCHA) FRY AFTER EXPOSURE TO THE WATER-SOLUBLE FRACTION OF PRUDHOE BAY CRUDE OIL
Thomas, R. E., and S. D. Rice. 1975.
Journal of the Fisheries Research Board of Canada 32(11):2221-2224.

The opercular rates of the pink salmon increased significantly for 9 to 12 hours after exposure to WSF of oil-water solutions.

Increases in rates were proportional to increases in dose. Recording changes in opercular rates is a suitable method for detecting sublethal physiological effects of stress.

Information source: J. F. Karinen, Investigation Chief,
Physiology-Bioassay Section, Auke Bay
Fisheries Laboratory, PO Box 155,
Auke Bay, AK 99821

R-046-78

GENETIC VARIATION AND RESISTANCE TO CARCINOGENS IN NATURAL WATERS

Principal Investigator:	Schultz, R. J.
Performing Organization:	University of Connecticut, Graduate School, Storrs, CT 06268
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561. No. R805195-01, Q625F-1-2
Period:	10/76 - 9/77
Funds:	$40,000 FY 77

Detection, Carcinogens, Petroleum products, Oil shale, Fish, *Bioassay

"The objective of this grant is to evaluate the feasibility of using isogenic fish to detect carcinogens. The validated bioassay system would be used to test the carcinogenic properties of compounds from petroleum and shale oil."

[SSIE No. GMA-4119]

R-047-78 (R-152-76)

ALASKAN OIL SEEPS - THEIR CHEMICAL AND BIOLOGICAL EFFECTS ON THE ENVIRONMENT

Principal Investigator:	Shaw, D. G.
Performing Organization:	University of Alaska, Institute of Marine Science, Fairbanks, AK 99701
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 SW 35th St., Corvallis, OR 97330. No. R803922-03; M625A-3
Period:	10/76 - 9/77
Funds:	$123,991 FY 77

Natural seepage, Chronic effects, Biological effects, Chemical effects, Intertidal zone, Alaska/Gulf of

"Objective is to relate a defined chronic input of petroleum in an intertidal environment to biological changes at the organism and community levels. The project will investigate oil seeps along the Gulf of Alaska that provide long-term, low-level input of petroleum into the marine intertidal environment."

[SSIE No. GMA-4260]

R-048-78

CULTURE OF MARINE ALGAE FOR EXPERIMENTAL USE

Principal Investigator: Steele, R. L.
Performing Organization: US Environmental Protection Agency,
Environmental Research Lab., S. Ferry Rd.,
Narragansett, RI 02882
Supporting Agency: US Environmental Protection Agency,
Office of Research & Development,
Environmental Research Lab., S. Ferry Rd.,
Narragansett, RI 02882. No. P608C-15
Period: 10/76 - 9/77
Funds: $45,600 FY 77

Algae, Hydrocarbons , Detection, Toxicity, *Bioassay , *Cultures

Selected macro-algae were cultured for use as bioassay organisms to detect toxic levels of oil, oil products, and other pollutants. Levels of sensitivity have been determined for two species: *Fucus edentatus* and *Laminaria maccahrina*. Brown algae with different life cycles were also to be tested.

[SSIE No. ZMA-1184]

Status: Results will be published in the proceedings of the IX International Seaweed Symposium.

Reports and Publications

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION
Steele, R. L. 1977.
Journal of Phycology 13 (Supplement):64. Abstract.

The author studied two genera of brown algae, *Fucus* and *Laminaria*, to measure oil pollution toxicity in these bioassay organisms. Four kinds of oil were tested and both algae were found to be sensitive at less than 100 ppb. Male reproductive cells were much more sensitive than eggs or female gametophytes.

R-049-78

IMPACT OF THE *METULA* OIL SPILL ON THE SUBTIDAL MACROBENTHOS OF THE STRAITS OF MAGELLAN

Principal Investigator: Swartz, R. C., and D. J. Baumgartner
Performing Organization: US Environmental Protection Agency,
Newport, OR 97365

Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 SW 35th St., Corvallis, OR 97330. No. M608C-99
Period: 10/76 - 9/77
Funds: $14,000 FY 77

Metula spill, Contamination, Sediments, Benthos, Biological effects, Magellan/Strait of

Research objectives are to assess the degree of hydrocarbon contamination of sediments and alterations in subtidal benthic community structure caused by the Metula spill in the Straits of Magellan. Forty-four samples of sediments and biological collections were made. Research is closely coordinated with that of Dr. Victor Gallardo, University of Concepcion, Chile.

[SSIE No. ZMA-1176]

Status: The initial cruise was completed in April 1976. The project is still ongoing as of April 10, 1978.

Reports and Publications

SUBTIDAL SURVEY OF THE STRAIT OF MAGELLAN IN THE VICINITY OF THE METULA OIL SPILL
Swartz, R. C., and V. A. Gallardo. 1976.
Antarctic Journal of the United States XI(3):186-187.

A survey of subtidal benthic communities and sediment oil contamination taken in April 1976 used 44 benthic grab, beach, and trawl stations. Quantities of oil were still on the beaches, below the surface of the upper intertidal zone, and in the estuaries nearly 2 years after the Metula spill. Beaches and inlets appear to be a continuing source of oil pollution in the Strait.

Information source: R. C. Swartz, USEPA, Corvallis Environmental Research Laboratory, Marine and Freshwater Ecology Branch, Newport Field Station, Marine Science Center, Newport, OR 97365

2. GENERAL ASPECTS

R-050-78 (R-212-74)
FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN MARINE COASTAL ECOSYSTEMS
Principal Investigator: Vanderhorst, J. R., and R. M. Bean

Performing Organization: Battelle Memorial Institute, PO Box 999, Richland, WA 99352
Supporting Agency: US Energy Research & Development Administration, Division of Biomedical & Environmental Research, 1717 H St. NW, Washington, DC 20545. Contract EY-76-C-06-1830
Period: 10/76 - 9/77

Hydrocarbons , Intertidal zone, Ecosystems, Mortality, Growth, Uptake, Fate, Mollusks

The long-range project objective is to study the fate and effects of petroleum in marine coastal ecosystems. Specific objectives are to measure the above in laboratory-held intertidal colonies and in populations of little-neck clams. A continuous-flow test system has been developed which operates on gravity, and can be adjusted to deliver from several mg/L down to 0.1 mg/L total oil. Statistically significant ($P = 0.001$) effects of No. 2 fuel oil on species richness, species diversity, and individual species occurrence patterns have been described. Prudhoe Bay crude is also being tested. Mortality, growth, and hydrocarbon uptake and retention in the little-neck clam are being assessed.

[SSIE No. ZPE-11592-1]

D. ASPECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL ASPECTS

R-051-78

TOXICITY TO MARINE ORGANISMS OF PETROCHEMICALS AND ENERGY RELATED ORGANIC SOLVENTS DERIVED FROM OFF-SHORE ACTIVITIES AND OCEAN DUMPING

Principal Investigator: Richards, N. L.
Performing Organization: US Environmental Protection Agency, Gulf Breeze Environmental Research Lab., Gulf Breeze, FL 32561
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561. No. Q625A-2-2
Period: 10/76 - 9/77
Funds: $20,000 FY 77

Petrochemicals, Marine organisms, Biological effects, Toxicity, Offshore drilling, Extraction, Oil transport, *Drilling muds

The objective of this research is to assess the effects of emissions from offshore petroleum exploitation, extraction, and transportation activities on marine organisms and communities. Single species and community bioassays will be continued on selected components of drilling muds. Whole drilling muds and other pollutants emitted from extraction activities such as cutting and man-mobilized petroleum hydrocarbons will be evaluated.

[SSIE No. ZMA-1113]

R-052-78

ENVIRONMENTAL EFFECTS OF OFFSHORE DRILLING AND OIL ON THE MARINE ENVIRONMENT

Principal Investigator: Schuh, N.
Performing Organization: US Navy, Coastal Systems Laboratory, Panama City, FL 32401
Supporting Agency: US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., Sabine Island, Gulf Breeze, FL 32561. Interagency No. D7-01134, Q625A-2-1
Period: 10/76 - 9/77
Funds: $439,988 FY 77

Offshore drilling, Extraction, Environmental effects, Fuel oil, Oil shale

"The work to be funded under this IAG includes the conduct of research to 1) determine the environmental effects of offshore oil extraction, 2) assess the effects on the marine environment of Bunker C fuel derived from shale oil. In order to simulate the conditions of the marine environment, the use of the Stage I Offshore Platform owned and maintained by the NCSL, Panama City, Florida, will be required."

[SSIE No. ZMA-1114]

Status: The Naval Coastal Systems Center is limited to providing facilities and labor support to EPA. Dr. Norman Richards, US EPA, Environmental Research Laboratory, Sabine Island, Gulf Breeze, FL 32561, is responsible for the research project.

Information source: C. M. Callahan, Head, T&E Support Department,
Naval Coastal Systems Center, Department of
the Navy, Panama City, FL 32407

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-053-78 (R-093-77)
DEEP OCEAN ENVIRONMENTAL STUDIES OF MARINE BACTERIA

Principal Investigator:	Colwell, R. R.
Performing Organization:	University of Maryland, School of Agriculture, College Park, MD 20742
Supporting Agency:	US National Science Foundation, Division of Ocean Sciences, 1800 G St. NW, Washington, DC 20550. No. OCE76-82655
Period:	1/78 - 12/78
Funds:	$32,500 FY 78

Biodegradation, Microorganisms, Distribution, Oceans

The object of this research is to determine the interaction of microorganisms with the deep-ocean environment under *in situ* conditions. Rates of utilization will be assessed using seawater samples enriched with chitin, cellulose, carbohydrates, urea, and other organic compounds. Biodegradation experiments will use substrates of petroleum, heavy metals, and pesticides. Other studies will cover metabolic activity, genetic experiments concerning geographic distribution, and the ecological significance of plasmids in the deep sea.

[SSIE No. CM-310-1]

Reports and Publications

INITIAL INVESTIGATIONS WITH A DEEP OCEAN *IN SITU* SAMPLER
Tabor, P. S., and R. R. Colwell.
Oceans '76. p. 13D-1-13D-4.

A deep ocean sampler capable of aseptically sampling and maintaining a seawater sample under *in situ* conditions of pressure and temperature has been developed and is described here.

MICROBIOLOGICAL STUDIES OF DECOMPRESSED AND UNDECOMPRESSED WATER SAMPLES COLLECTED WITH A DEEP OCEAN SAMPLER
Colwell, R. R., and P. S. Tabor. 1977.
Benthic Boundary Layer and Geochemistry of Interstitial Waters. Proceedings of the Joint Oceanographic Assembly, Edinburgh, Scotland,(in press).

A newly developed sampler and its application are described. Research objectives are to use the sampler to investigate the structure and function of microbial populations found in the deep ocean.

MICROBIAL ECOLOGY STUDIES OF THE METULA SPILL IN THE STRAITS OF MAGELLAN
Colwell, R. R., A. L. Mills, J. D. Walker, P. Garcia-Tello, and V. Campos-P.
Proceedings: Oil/Environment-1977. An International Symposium. "Recovery of Oiled Northern Marine Environments." Held in Halifax, Nova Scotia, Canada on October 10, 1977.

The *Metula* spill of August 1974 was studied from May 1976 - January 1977. Initial sampling showed increased heterotrophic bacterial populations at oil-impacted sites, and a cold-tolerant population of petroleum degrading bacteria was observed. It was concluded from biodegradation studies that oil degradation under *in situ* conditions proceeds relatively slowly. This research was funded by NSF Grant No. ENV 76-08310, "Microbiological Effects of Petroleum Accumulation on Beaches."

Information Source: R. R. Colwell, Department of Microbiology,
Division of Agricultural and Life Sciences,
University of Maryland, College Park, MD 20742

R-054-78
DEGRADATION OF ORGANIC POLLUTANTS IN COLD CLIMATE ECOSYSTEMS

Principal Investigator:	Gordon, R. C., and C. V. Davenport
Performing Organization:	US Environmental Protection Agency, Environmental Research Lab, Fairbanks, AK 99701
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development, Environmental Research Lab., 200 SW 35th St., Corvallis, OR 97330. No. M608A-64
Period:	10/76 - 9/77
Funds:	$42,000 FY 77

Biodegradation, Crude oil, Microorganisms, Metabolism, Baseline studies, Decomposition, Arctic, Subarctic regions

"The objectives are: 1) to complete the literature review and 'State of the Art' paper on oil degradation under arctic and subarctic conditions, 2) to determine immediate and long term effects of crude oil on indigenous microbial populations and their metabolic activities in the terrestrial and aquatic environments, and 3) to begin to assess the role of indigenous microorganisms in crude oil degradation in cold climate ecosystems."

[SSIE No. ZMA-1169]

R-055-78
MARINE PROTOZOAN MICROSOMAL ACTIVATION OF OIL POLLUTANTS TO MUTAGENS

Principal Investigator:	Lindmark, D. G.
Performing Organization:	Rockefeller University, Graduate School, York Ave. & 66th St., New York, NY 10021
Supporting Agency:	US Environmental Protection Agency, Office of Research & Development,

Environmental Research Lab., Sabine
Island, Gulf Breeze, FL 32561.
No. R805364-01, Q625F-1-4
Period: 10/76 - 9/77
Funds: $25,000 FY 77

Biodegradation, Bacteria, *Marine protozoa, *Microsomes

"The project consists of the isolation of microsomes from various marine protozoa. Work will be done on a small scale under laboratory conditions."

[SSIE No. GMA-4124]

2. PHYSICAL/CHEMICAL CHANGES

R-056-78
CONDUCT A STUDY TO INVESTIGATE THE EFFECTS OF OIL SLICK PROPERTIES ON THE DISPERSION OF AN OIL SLICK
Principal Investigator: Coffee, M. M.
Performing Organization: Massachusetts Institute of Technology,
Cambridge, MA 02139
Supporting Agency: US Coast Guard, Department of Transportation,
400 7th St. SW, Washington, DC 20590.
Contract CG-61,802-A(CR)
Period: 9/76 - 11/77
Funds: $121,770

Oil slicks, Dispersions, Physical effects, *Literature survey

"The objective is to investigate the existing literature on the available empirical and theoretical bases for determining the dispersion of oil slicks and how this dispersion is affected by slick geometry, oil physical properties and oil composition."

[from Maritime Research Information Service Abstracts Vol. 15:#14
059949. 1977]

3. GENERAL FATE OF OIL

R-057-78 (R-172-76)
DEVELOPMENT OF A CHEMICAL, STABILITY, AND TRANSPORT MODEL OF OIL SHALE PROCESS WASTES IN SOIL
Principal Investigator: Routson, R. C., R. M. Bean, R. J. Serne,
and R. E. Wildung

Performing Organization: Battelle Memorial Institute, PO Box 999, Richland, WA 99352
Supporting Agency: US Energy Research & Development Administration, Division of Biomedical & Environmental Research, 1717 H St. NW, Washington, DC 20545. Contract EY-76-C-06-1830
Period: 10/76 - 9/77

Oil shale, Wastewaters, Fate, Soil, Models, Sources, *Pollutant transport

The source, transport, and physical and chemical reactions, stability, and fate of oil shale process wastes will be investigated and modeled. Batch and column studies will be used to measure the equilibrium and kinetic parameters which control the fate and transport of the wastes and leachates through typical soil systems of oil shale regions. A computer simulation program will be developed to predict pollutant transport through these soils.

Status: "Work to date includes completion of a comprehensive literature review, characterization of Bureau of Mines spent shale and retort waste water, sorption of collidine on a soil and spent shale, and modification of a computer model to accommodate inorganic complexes, Langmuir isothermal sorption, and N equilibria."

[SSIE No. ZPE-11372-1]

Status: This project has been incorporated into another program entitled "Terrestrial Effects of Oil Shale Development," of which R. E. Wildung is the principal investigator.

Information source: R. E. Wildung, Manager, Environmental Chemistry, Ecosystems Department, Battelle Pacific Northwest Laboratories, PO Box 999, Richland, WA 99352

SECTION III: CURRENT CONFERENCES

* Additional information not available at time of publication
** Possible oil-related topic or paper

FEB 27-MAR 3 29th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, Ohio, 1978

Oil Pollution Related Papers

Session: Oil and Other Organic Pollutants Analysis II

Paper 551
FURTHER INVESTIGATIONS IN FLUORESCENCE AND LOW TEMPERATURE LUMINESCENCE FOR OIL IDENTIFICATION
Eastwood, D., and M. S. Henrick

Paper 552
TOTAL LUMINESCENCE STUDY OF THE EFFECTS OF ARTIFICIAL WEATHERING ON OILS
Hornig, A. W., and L. P. Giering

Paper 553
IDENTIFICATION AND QUANTITATION OF ISOMETRIC POLYCYCLIC AUTOMATIC HYDROCARBONS IN MIXTURES BY MATRIX-ISOLATION FLUORESCENCE SPECTROSCOPY
Wehry, E. L., G. Mamantav, P. Tokousbalides, R. C. Stroupe, and R. B. Dickinson, Jr.

Paper 554
FLUORESCENCE EXCITATION-EMISSION CONTOUR MAPPING OF HPLC ELUATES
Jadamec, J. R., W. A. Saner, E. Kallet, S. Cravitt, and Y. Talmi

Paper 555
**CHARACTERIZATION OF HPLC ELUATES USING OMA FOR UV ABSORPTION AND FLUORESCENCE MAPPING
Saner, W. A., J. R. Jadamec, and Y. Talmi

Paper 556
LABORATORY WEATHERING OF PETROLEUM
Flanigan, G. A.

Paper 557
**AUTOMATIC ANALYSIS OF ORGANIC POLLUTANTS IN WATER VIA GS/MS
Beggs, D., and B. Holtz

Paper 558
**POLLUTANT ANALYSIS VIA NEGATIVE ION CHEMICAL IONIZATION MASS SPECTROMETRY
Beggs, D., A. Malera, and G. Mathers

Paper 560
**AUTOMATED ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN WATER
Snyder, W. D.

FFI contact Edwin S. Hodge, Carnegie-Mellon University, Mellon Institute, 4440 5th Avenue, Pittsburgh, PA 15213

MAR 30 Vessel Pollution Liability and Certification Seminar, Houston, Texas, 1978
Sponsored by Sea Grant College Program, Texas A&M University

Seminar Topics

**HAZARDOUS SUBSTANCES COVERED BY THE FEDERAL WATER POLLUTION CONTROL ACT
Flaherty, L. M.

ROLE OF THE US COAST GUARD IN OIL SPILL CLEANUP AND POLLUTION PREVENTION
Palmer, S., Jr.

POLLUTION AND "SUPER FUND" LEGISLATION: THE EFFECTS ON VESSEL LIABILITY AND FINANCIAL RESPONSIBILITY AS VIEWED BY THE MARINE INDUSTRY
Menton, O. R.

PANEL DISCUSSION: VESSEL LIABILITY AND FINANCIAL RESPONSIBILITY CERTIFICATION FOR OIL AND HAZARDOUS SUBSTANCES POLLUTION
Bayard, H. W., Jr., A. Pankopf, and L. Fuller

FFI contact Dewayne Hollin, Conference Coordinator,
12605 East Freeway, Suite 302, Houston, TX 77015

*APR 5-6 Workshop on the Role of Planning in the Control of Environmental Pollution, Bristol, United Kingdom, 1978

FFI contact Jane Dumore, NSCA, 136 North Street, Brighton,
Sussex, UK

APR 18-20 3rd Annual Conference on Treatment and Disposal of Industrial Wastewaters and Residues, Houston, TX, 1978
Sponsored by Hazardous Materials Control Research Institute, University of Houston, American Institute of Chemical Engineers, and Information Transfer, Inc.

Oil Pollution Related Papers

Session VB: Treatment of Petroleum and Petrochemical Wastes

PETROLEUM REFINERY CONFIGURATION AND WASTEWATER TREATMENT COSTS
Finelt, S., and J. R. Crump

MUTANT BACTERIA FOR CONTROL OF OIL AND GREASE IN THE WASTEWATER TREATMENT AND DISPOSAL SYSTEM OF AN INTEGRATED MARINE/LAND TERMINAL
Zitrides, T., A. Galen, and E. Warner

Session VIIIA: Treatment of Organic Wastes

**SELECTIVE REMOVAL OF CERTAIN BIOREFRACTORY HYDROCARBONS FROM EFFLUENTS WITH POLYMERIC ADSORBENTS
Albaugh, E. W., J. Freel, and T. E. Gerdes

Session IXA: Joint Treatment

**COMBINED TREATMENT OF PETROCHEMICAL AND MUNICIPAL WASTEWATERS
Reynolds, T. D., P. E. Ferguson, and J. R. Ferguson

FFI contact Hazardous Materials Control Research Institute,
c/o Information Transfer Inc., Suite 202, 1150 Rockville Pike,
Rockville, MD 20852

APR 25-26 Environmental Law and Regulations, Introductory Course, Denver, Colorado, 1978
Sponsored by Government Institutes, Inc.

Oil Pollution Related Topics

Session: Water Pollution Control
Discussed were the Federal Water Pollution Control Act including the 1977 amendments; federal/state regulatory framework; technology-based effluent standards and guidelines; impact on direct and indirect discharges; NPDES permit process; abatement actions; special provisions for oil, hazardous and toxic pollutants; and more.

FFI contact Nancy McNerney, Government Institutes, Inc.
4733 Bethesda Avenue NW, Washington, DC 20014

APR 27-29 SNAME Spring Meeting/STAR Symposium, New London, Connecticut, 1978
Sponsored by The New England Section, The Society of Naval Architects and Marine Engineers

Oil Pollution Related Papers

Session B: Pollution Realities

Paper 15
ARGO MERCHANT OIL: WHERE DID IT GO?
Jadamec, J. R., G. L. Hufford, S. Fortier, and S. Buchanan

Paper 16
DEEP WATER PORT POLLUTION RESPONSE PROJECT
Griffiths, R. A., I. M. Lissauer, and J. E. Ferguson, Jr.

Session: Pollution Liabilities Defined

Paper 17
THE NEW DIRECTION FOR OIL SPILL LAW
Smith, S. L., and M. Smith, Jr.

TANKERS: SAFETY AND POLLUTION PANEL DISCUSSION
Environmental problems caused by tankers and their associated oil spills are addressed in conjunction with measures taken at the February 1978 IMCO Conference

FFI contact Trevor Lewis-Jones, Manager, Publications and Technical Programs, The Society of Naval Architects and Marine Engineers, One World Trade Center, Suite 1369, New York, NY 10048

APR 26-28 Joint MMT/End Workshop on Management and Control of Oil Blowouts in the North Sea and Environmental Standard Setting (Location Unknown), 1978
Sponsored by the International Institute for Applied Systems Analysis (IIASA)

The joint workshop included discussion of disaster management of oil blowouts associated with offshore production platforms in the North Sea. Critical decision points, risk assessment, alternative solution, and impacts of blowout disaster were reviewed. Theoretical and institutional approaches to standard setting were analyzed.

Workshop: Oil Blowout Management and Control - APR 26-28
The sessions focused on four major topics; prevention, control, cleanup, and environmental impacts. The emphasis was on the human aspect of the topics (i.e., organization and management), although physical aspects (i.e., engineering and equipment) were also included.

Workshop: Standard Setting - MAY 2-3
Oil-related case studies included setting emission standards for chronic oil discharges in the North Sea and setting safety standards to prevent blowout risks from North Sea production platforms.

FFI contact International Institute for Applied Systems Analysis, A-2361 Laxenburg, Schloss Laxenburg, Austria

JUN 14-17 Conference on Assessment of the Ecological Impacts of Oil Spills, Keystone, Colorado, 1978
Coordinated by American Institute of Biological Sciences
Sponsored by API, BLM, USCG, EPA, ERDA, and NOAA

Conference Program

Session: Keynote Addresses

OIL SPILLS IN THE COASTAL ZONE - THE STATISTICAL PICTURE
Fugaro, A.

OIL SPILLS - AN INDUSTRIAL POINT OF VIEW
Haxby, L. P.

OIL SPILLS - A PUBLIC POINT OF VIEW
Murphy, E. F.

Session: The Socio-Economic-Legal Aspects of Oil Spills

COMPREHENSIVE OIL POLLUTION LIABILITY AND COMPENSATION - WHERE DOES THE ISSUE STAND TODAY?
Couper, F. E.

FROM *TORREY CANYON* TO EKOFISK: A STUDY OF BRITISH LEGISLATION BY CRISIS
Fitzmaurice, V.

SOME LEGAL CONSIDERATIONS RELATIVE TO OIL POLLUTION LIABILITY AND COMPENSATION
Fidell, E., and R. A. DuBey

ECONOMIC VALUES AND ECOLOGICAL IMPACTS ASSOCIATED WITH OIL SPILLS
Wilman, E. A.

Case History: The Impact of the ARGO MERCHANT Spill (12/15/76)

MODELING THE BEHAVIOR OF THE SPILL
Galt, J.

FATE OF THE OIL
MacLeod, W.

IMPACT OF OIL ON PELAGIC ORGANISMS
Kuhnhold, W.

IMPACT OF THE OIL ON BIRDS AND MAMMALS
Morson, B.

Case History: The Impact of the BOUCHARD #65 Barge Spill in Buzzards Bay (1/28/77)

THE OIL-ICE INTERACTION
Deslauriers, P.

CHEMICAL ANALYSES
Uyeda, M.

ENVIRONMENTAL IMPACT OF THE OIL
Maiero, D.

Case History: The Impact of the NEPCO #140 Barge Spill in the St. Lawrence River (6/23/76)

THE NEED FOR AND THE SCOPE OF THE SPILL CLEANUP
Nadeau, R.

BIOLOGICAL AND CHEMICAL ASPECTS OF THE SPILL
Alexander, M. M.

ECONOMIC IMPACT STUDIES
Palm, J.

Case Histories (Session I): Highlights Regarding the Impacts of Other Pertinent Oil Spills

EFFECTS OF THE BARGE STC-101 SPILL IN CHESAPEAKE BAY 2/2/76)
Ayers, W.

THE URQUIOLA OIL SPILL (5/12/76): OBSERVATIONS OF BIOLOGICAL DAMAGE ALONG THE SPANISH COAST
Stein, R. J., E. R. Gundlach, and M. O. Hayes

FATE OF THE OIL SPILLED BY THE USNS POTOMAC IN MELVILLE BIGHT, GREENLAND (8/5/77)
Peterson, H.

EFFECT OF AN OIL SPILL ON SALT MARSHES AT HARBOR ISLAND, TX
Holt S.

Case Histories (Session II): Highlights Regarding the Impacts of Other Pertinent Oil Spills

The METULA Tanker Spill (8/9/74) in the Straits of Magellan

PHYSICAL ASPECTS OF THE SPILL
Hann, R.

BIOLOGICAL ASPECTS OF THE SPILL
Straughan, D.

The SANSINERA Oil Spill (12/17/76) in the San Pedro, CA Harbor

FATE OF THE OIL
Kolpack, R.

BIOLOGICAL IMPACTS OF THE SPILL
Soule, D. R.

Case History: The Impact of the EKOFISK BRAVO Blowout (4/22/77) in the North Sea

THE FATE AND WEATHERING OF SURFACE OIL FROM THE BRAVO BLOWOUT
Audunson, T.

THE EKOFISK BRAVO BLOWOUT: PETROLEUM HYDROCARBONS IN THE SEA
Grahl-Nielsen, O.

PRESENCE OF OIL IN THE SEDIMENT AND BENTHIC COMMUNITY SURROUNDING THE EKOFISK FIELD AFTER THE BRAVO BLOWOUT
Johnson, J.

BIOLOGICAL MONITORING IN THE EKOFISK OILFIELD
Addy, J. M., B. M. Dicks, J. P. Hartley, and D. Levell

EFFECTS OF THE EKOFISK BRAVO BLOWOUT ON HYDROCARBON RESIDUES IN FISH
Whittle, K. J., P. R. Mackie, J. Rarmer, and R. Hardy

Research Papers: Effects of Spills on Wildlife

BIOLOGICAL EFFECTS OF PETROLEUM ON AQUATIC BIRDS
Hoffman, D. J.

EFFECTS OF LOW LEVEL OIL EXPOSURE ON MALLARD DUCKS
Lawler, G. C.

UPTAKE AND CLEARANCE OF PETROLEUM HYDROCARBONS FOLLOWING EXPERIMENTAL OIL SPILL AND INGESTION EXPOSURE IN ARCTIC RINGED SEALS
Engelhardt, F. R., J. R. Geraci, and T. G. Smith

DOES A PROBLEM EXIST RELATIVE TO SMALL SEA TURTLES AND OIL SPILLS?
Witham, R.

Research Papers: Effects of Spills on Water Column Organisms

SHORT TERM EFFECTS OF OIL ON PELAGIC ORGANISMS IN CONTROLLED ECOSYSTEMS
Lee, F.

CILIATES AS BIOINDICATORS OF OIL POLLUTION
Lanier, J. J., and M. Light

LONG-TERM EFFECTS OF LOW CONCENTRATIONS OF THE WATER ACCOMMODATED FRACTIONS OF #2 FUEL OIL ON THE REPRODUCTION IN WINTER FLOUNDER
Everich, D., and W. Kuhnhold

IMPACT OF CRUDE OIL ON PLANKTONIC FRESHWATER ECOSYSTEMS
Scott, B. R., and D. B. Shindler

Research Papers: Effects of Spills on Benthic Organisms

THE INFAUNAL BENTHOS OF PETROLEUM-CONTAMINATED SEDIMENTS: A COMMUNITY STUDY OF A NATURAL OIL SEEP
Spies, R. B., and P. H. Davis

EFFECTS OF CHRONIC CONCENTRATIONS OF PETROLEUM HYDROCARBONS ON SPAWNING STAGES OF ADULT STARRY FLOUNDER AND LITTLENECK CLAMS
Whipple, A., G. Yocom, and R. Smart

ESTIMATION OF EFFECTS FROM OIL ON INTERTIDAL POPULATIONS: EXPERIMENTAL PERTURBATIONS VERSUS NATURAL VARIATION
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Ho, C. L.

Research Papers: Effects of Spills in Extreme Climate Zones

ASSESSMENT OF THE ECOLOGICAL EFFECTS OF AN OIL SPILL IN AN OFFSHORE SUB-ARCTIC ENVIRONMENT
Birchard, E. C.

POTENTIAL LONG-TERM EFFECTS OF PRUDHOE BAY CRUDE OIL IN ARCTIC SEDIMENTS ON INDIGENOUS BENTHIC INVERTEBRATE COMMUNITIES
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Milan, C., and T. Whelan

ECOLOGICAL CONSEQUENCES OF PETROLEUM SPILLAGE IN PUERTO RICO
Lopez, J. M.

Research Papers: An Assessment of the Ecological Impact of Oil Spills Keyed to Long-Term Studies

A LONG-TERM ECOLOGICAL IMPACT ASSESSMENT KEYED TO THE ARROW TANKER SPILL (2/4/70) IN CHEDABUCTO BAY, NOVA SCOTIA
Vandermeulen, J. H.

A LONG-TERM ECOLOGICAL IMPACT ASSESSMENT KEYED TO OBSERVATIONS OF VARIOUS OIL SPILLS IN BRITISH PORTS
Baker, J.

FFI contact The American Institute of Biological Sciences, Special Science Programs, 1401 Wilson Blvd., Arlington, VA 22209

*JUL 2-8 International Symposium on Remote Sensing for Observation and Inventory of Earth Resources and the Endangered Environment, Freiburg, Federal Republic of Germany, 1978

No address given

JUL 10-13 Eighth Annual Intersociety Conference on Environmental Systems, San Diego, California, 1978

Oil Pollution Related Topics

**Topic Area I: Marine Technology and Applications for Effluent Control, Environmental Control, and Waste Management

FFI contact Paul Schatzberg, Naval Ship R&D Center, Code 286, Annapolis, MD 21402

JUL 17-21 Chemical Control of Marine Oil Spills, Plymouth, New Hampshire, 1978
Sponsored by Gordon Research Conferences, Plymouth State College

Session: Microbial Utilization of Petroleum Hydrocarbons and Petroleum Hydrocarbon-Chemical Treating Agents Mixtures

EFFECTS OF DISPERSANTS AND EMULSIFYING AGENTS ON DEGRADATION OF PETROLEUM HYDROCARBONS
Stewart, J. E.

INFLUENCE OF DISPERSANTS ON MICROBIAL UTILIZATION OF PETROLEUM HYDROCARBONS AS APPLIED TO A MESO-SCALE TEST SYSTEM
Bhattacharya, S.

Session: Chemical and Physical Nature of Spilled Oil

CHEMICAL AND PHYSICAL PROCESSES AND RATES OF HYDROGEN TRANSPORT FROM SURFACE OIL
Mackay, D.

CHEMICAL AND PHYSICAL PROCESSES AND RATES OF HYDROGEN TRANSPORT FROM SURFACE OIL
Butler, J.

Session: Biological Response of Marine Organisms Subjected to Spilled Oil and Chemical Control Agents

NEW TOXICITY RESEARCH: OIL AND DISPERSANTS
Norton, M., and S. L. Franklin

FUTURE RESEARCH ON SOLVING THE DISPERSANT PROBLEM
Baker, J. M.

Session: Chemistry and Physics of Oil Spill Treating Agents

ANALYTICAL CHEMISTRY OF OIL-WATER-DISPERSANT MIXTURES
Brown, C.

SURFACE CHEMISTRY OF SURFACTANTS-OIL AND WATER MIXTURES
Donnelly, R.

Session: Physical Entrainment and Dispersion in the Natural Environment

SOME ENTRAINMENT PROCESSES IN THE NATURAL ENVIRONMENT
Cornillon, P.

MIXING ENERGY OF OIL AND OIL-DISPERSANT MIXTURES WITH SEA WATER
Kim, T. J. M.

THE ROLE OF MODELING IN THE USE OF DISPERSANTS--WHAT WE KNOW AND DON'T KNOW ABOUT THE DISPERSANT PROCESS
Cornillon, P., and M. Spaulding

Session: Field Research on the Use of Dispersants and Chemical Treating Agents

FIELD RESEARCH ON THE USE OF DISPERSANTS
Cormack, D.

RESEARCH ON CHEMICAL TREATMENT OF OIL SPILLS ON BEACHES AND OPEN WATER
Dorrler, J. S., and L. McCarthy

Session: Biological Response of Marine Organisms Subjected to Spilled Oil and Chemical Control Agents

BIOLOGICAL HAZARDS OF CONTROLLING MARINE OIL SPILLS WITH CHEMICALS--A CASE FOR CAUTION
Wells, P. G.

BIOLOGICAL HAZARDS OF CONTROLLING MARINE OIL SPILLS WITH CHEMICALS--ARE WE TOO CAUTIOUS?
Penrose, W. R.

LABORATORY STUDIES OF THE LETHAL AND SUBLETHAL EFFECTS OF OIL
Ordzie, C. J.

FFI contact Dr. Alexander M. Cruickshank, Director, Gordon Research Conferences, Pastore Chemical Laboratory, University of Rhode Island, Kingston, RI 02881

SEPT 5-8 *3rd Offshore North Sea Technology Conference and Exhibition,
Stavanger, Norway, 1978
Sponsored by Norwegian Petroleum Society (NPS)

Oil pollution related topics include risk analysis in offshore operations and blow-out prevention.

FFI contact ONS '78 Conference Office, c/o Norwegian Petroleum Society, Kronprinsensgate 9, Oslo 2, Norway

SEPT 6-8 *OCEANS '78 Conference, Washington, DC, 1978
Sponsored by Marine Technology Society (MTS)

Theme: "The Ocean Challenge" emphasizes utilizing the oceans' resources to sustain and enhance the quality of life on earth. Paper topics will include water quality/pollution, offshore facilities, remote sensing, and ocean surveillance/enforcement.

FFI contact Marine Technology Society, 1730 M Street NW, Washington, DC 20036

SEPT 26-30 International Oil Pollution Prevention Exhibition and Conference, Hamburg, Federal Republic of Germany, 1978

Topics include government and legislative oil pollution activity, technical methods of prevention and cleanup, and legal and financial responsibility for pollution incidents.

FFI contact IOPPEC, Hamburg Messe und Congress GmbH, Postfach 302 320, d-2000 Hamburg, GFR

OCT 8-13 Disposal of Oil and Related Materials and Debris Resulting from a Spill Cleanup Operation, New Orleans, Louisiana, 1978
Sponsored by Committee F-20 on Spill Control Systems of the American Society for Testing and Materials (ASTM)

The symposium will investigate the subject, examining the current state-of-the-art, identifying weaknesses, and reviewing disposal procedures. Participants will contribute to the development of universal guidelines and standards of disposal procedures. Paper topics include emergency handling and storage of oily wastes, disposal techniques, legislation, and equipment.

FFI contact Sam W. Bowman, ASTM, 1916 Race Street, Philadelphia, PA 19103

OCT 25-28 3rd International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio, 1978
Sponsored by the Battelle Columbus Laboratories

Oil Pollution Related Papers

Session 4: Chemistry

QUANTITATIVE ANALYSIS OF SELECTED PAHS IN AQUEOUS EFFLUENT BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
Wilkinson, J. E., P. E. Strup, and P. W. Jones

Session 6: Chemistry

PAHS AND THEIR DERIVATIVES IN THE MARINE ECOSYSTEM
Hardy, R.

Session 8: Chemistry

DEVELOPMENT OF AN AQUEOUS POLYNUCLEAR AROMATIC HYDROCARBON REFERENCE MATERIAL
May, W. E., J. M. Brown, S. N. Chesler, F. Guenther, H. S. Hertz, and S. A. Wise

FFI contact Peter W. Jones, Symposium Chairperson, Battelle Institute, Columbus Laboratories, Columbus, Ohio 43201

MASTER LIST OF KEYWORDS

S: See
SA: See also

Absorption
Activated sludge
Acute effects
Adriatic Sea
Adsorption
Aegean Sea
Africa
Alabama
Alaska
Alaska coast
Alaska, Gulf of
Algae ... SA: Phytoplankton
Analytical techniques ... SA: Chemical analysis; Source identification
Animals
Annelida ... SA: Polychaetes
Antarctica
API
Arabian Sea
Arctic
Arctic Ocean
Argentina
Argo Merchant Spill
Aromatic hydrocarbons ... SA: Hydrocarbons; PAH
Asia
Atlantic coast
Atlantic Ocean
Australia
Bacteria
Bahamas
Ballast
Baltic Sea
Bantry Bay
Barent Sea
Baseline studies
Beaches
Beaufort Sea
Behavior
Belgium
Bengal, Bay of
Benthos
Bering Sea
Bibliographies
Bilges
Biodegradation
Biological effects ... SA: Toxicity; Acute effects; Chronic effects
Biological treatment
Biomass
Birds
Biscay, Bay of
Black Sea
BLM
Blowout prevention
Blowouts
Book review
Booms
Brazil
California
California, Southern
Canada
Carcinogens ... SA: Health Hazards; PAH
Caribbean Sea
Caspian Sea
Chedabucto Bay
Chemical Analysis ... SA: Analytical techniques; Source identification
Chemical effects
Chesapeake Bay
Chile
China
Chromatography
Chronic effects
Coalescence
Coasts
Colorado
Compensation
Connecticut
Conservation
Contaminants
Contamination
Contingency planning
Corals
Coral reefs
Cost analysis
Crankcase oil
Crude oil
Crustaceans
Decomposition

Delaware
Delaware Bay
Denmark
Design-engineering
Detection ... SA: Monitoring; Chemical analysis
Development ... SA: Offshore development
Dispersants
Dispersions
Disposal ... SA: Waste oil disposal; Wastewater disposal
Distillation
Distribution
DOE
Drift ... SA: Movement; Spreading
Drilling ... SA: Offshore drilling; Oil wells
East China Sea
Echinoderms
Economic effects
Economics ... SA: Cost analysis
Ecosystems
Ecuador
Effluent treatment ... S: Wastewater treatment
EIS
Ekofisk blowout
Emulsification
Emulsifiers
Emulsions
Engineering ... S: Design-engineering
England
English Channel
Environmental deterioration
Environmental effects
Environmental Impact Statement ... S: EIS
Environmental management
Environmental protection
EPA
Equipment ... SA: Product information
ERDA
Estuaries
Evaporation
Exploration ... SA: Offshore exploration; Production
Extraction
Fate
FEA
Filtration ... SA: Flocculation; Ultrafiltration
Finland
Fish
Fisheries
Flocculation ... SA: Filtration
Florida
Flotation
Food web
Foreign governments
Fossil fuels
France
Freshwater
Fuel oil
Fuels
Fungi
Gas, liquid chromatography ... S: Chromatography
Gasoline
Georges Bank
Georgia
Germany, East
Germany, West
Gibralter, Strait of
Government agencies ... SA: US Government, State governments
Gravity separation
Great Lakes
Greenland
Groundwater
Growth
Guidelines ... SA: Manuals
Habitats
Harbors
Health hazards ... SA: Carcinogens
Hydrocarbons ... SA: Aromatic hydrocarbons; Crude oil; PAH
Ice
Illinois
IMCO
Incineration
India
Indian Ocean
Indonesia
Industries ... SA: Oil industry
Information systems
Infrared spectroscopy ... S: Spectroscopy
Inland
Insurance
International agreements

International conventions ...
  SA: Regulations; Legislation
Intertidal zone
Invertebrates
Iran
Iraq
Ireland
Israel
Italy
Japan
Japan, Sea of
Kentucky
Korea/South
Kuwait
Labrador Sea
Lakes ... SA: Great Lakes
Latin America
Law enforcement
Leakage
Legislation ... SA: Regulations;
  International conventions
Liability
Louisiana
Lubricating oil
Magellan, Strait of
Maine
Malaysia
Manuals ... SA: Guidelines
Marine mammals
Marine organisms
Marshes
Maryland
Massachusetts
Mass spectroscopy ...
  S: Spectroscopy
Mediterranean Sea
Metabolism
Metula spill
Mexico
Mexico, Gulf of
Michigan
Microorganisms ... SA: Algae;
  Bacteria; Fungi; Yeasts
Middle East
Mississippi
Mississippi River
Models
Mollusks
Monitoring ... SA: Detection;
  Remote sensing; Sampling
Mortality
Movement ... SA: Spreading; Drift
Narragansett Bay
Natural seepage
Netherlands
Neuston
New Hampshire
New Jersey
New Mexico
New York
Niches
NOAA
North Carolina
North Sea
North Vietnam
Norway
Norwegian Sea
Oceans
OCS
Offshore development
Offshore drilling
Offshore exploration
Offshore production
Ohio
Oil ... S: Crude oil; Fuel oil;
  lubricating oil; Crankcase oil;
  Waste oil
Oil discharges
Oil fields ... SA: Production
Oil-gas leasing
Oil industry
Oil shale
Oil slicks
Oil spills
Oil tanks
Oil terminals
Oil transfer
Oil transport
Oil-water separation ... SA:
  Wastewater treatment
Oil wells ... SA: Drilling; production;
  Offshore drilling; Offshore production
Okhotsk, Sea of
Olympic Games spill
Onshore impacts
Oregon
Oxidation ... SA: Biodegradation;
  Weathering
Pacific Ocean
PAH
Patent
Pennsylvania

Personnel training
Petrochemicals
Petroleum ... S: Crude oil
Petroleum industry ... S: Oil industry
Petroleum products
pH control
Philippines
Physical effects
Phytoplankton
Pipelines
Plankton ... SA: Phytoplankton; Zooplankton
Plants ... SA: Vegetation
Platforms
Poland
Pollution control
Pollution prevention ... SA: Environmental protection; Contingency planning
Polychaetes
Ports
Portugal
Precipitation
Product information ... SA: Equipment
Production ... SA: Offshore production; Drilling; Offshore drilling
Prudhoe Bay
Puerto Rico
Puget Sound
Reclamation ... SA: Recycling; Reuse
Recycling ... SA: Reclamation; Reuse
Red Sea
Refineries
Refining
Regulations ... SA: Legislation; International conventions
Release
Remote sensing ... SA: Monitoring; Detection
Reproduction
Residual Oils
Resource Management
Restoration
Reuse ... SA: Reclamation; Recycling
Rhine River
Rhode Island
Rivers
Ross Sea
Safety
Sampling ... SA: Monitoring; Detection
San Francisco Bay
Santa Barbara Channel
Sargasso Sea
Saudi Arabia
Scotland
Sea surface
Seawater
Sedimentation
Sediments
Segregated ballast
Ships ... SA: Tankers
Shorelines
Sinking agents
Skimmers
Sludge ... SA: Activated sludge
Social effects
Socio-economic effects
Soil
Solid wastes
Solubility
Solution
Solvents
Source identification
Sources
South Africa
South Carolina
South China Sea
Spain
Spectrometry
Spectroscopy
Spill cleanup
Spill containment
Spill disposal
Spill recovery
Spreading ... SA: Movement; Drift
St. Lawrence River
Standing crop
State governments ... SA: US Government; Government agencies
Statistical analysis
Statistics
Storage
Streams
Subarctic regions
Sublethal effects
Superports ... S: Ports
Supertankers ... S: Tankers
Surfactants

Surveillance
Sweden
Syria
Tankers ... SA: Ships
Tar
Tar sands
Texas
Torrey Canyon
Toxicity ... SA: Biological effects
Tropical regions
Turkey
UK
Ultrafiltration ... SA: Filtration
UN
Uptake
Urquiola spill
US
USCG
US Government ... SA: State governments; Government agencies
USGS
USN
USSR
Vegetation ... SA: Plants
Venezuela
Vertebrates
Vietnam
Virginia
Virgin Islands
Washington
Waste oil
Waste oil treatment
Wastewaters
Wastewater treatment
Water quality
Water soluble fractions ... S: WSF
Weathering
Weddell Sea
West Indies
Wildlife
WSF
Yeasts
Yugoslavia
Zooplankton

SUBJECT INDEX

THE SUBJECT INDEX IS A PERMUTED INDEX THAT LISTS ALPHABETICALLY THE KEYWORDS AND CORRESPONDING CITATION NUMBER ASSIGNED TO EACH ABSTRACT IN SECTION I (C-   -78) AND IN SECTION II (R-   -78). THESE KEYWORDS ARE SELECTED FROM THE MASTER LIST, P.   . FREE LANGUAGE TERMS WHICH ARE INCLUDED TO GIVE MORE SPECIFIC INFORMATION ABOUT AN ENTRY ARE PRECEDED BY AN * SIGN IN THE SUBJECT INDEX.

0391 ABSORPTION, SPILL CLEANUP, *FORBENT, PRODUCT INFORMATION,
0401 ABSORPTION, FUEL OIL, SPILL CLEANUP, *POLYURETHANE FOAM,
0403 ABSORPTION, SPILL CLEANUP, PATENT, EQUIPMENT, *POLYPROPYLENE,
0415 ABSORPTION, SPILL CLEANUP, PATENT, *PINE CHIPS,
0420 ABSORPTION, SPILL CLEANUP, POLLUTION PREVENTION, OIL TANKS, EMULSIONS, *DETERGENTS,
0421 ABSORPTION, SPILL CLEANUP, PATENT, *COCONUT SHELL,
0424 ABSORPTION, SPILL CLEANUP, PRODUCT INFORMATION, *TREE BARK CHIPS,
0426 ABSORPTION, PRODUCT INFORMATION, SPILL CLEANUP, *VISCOUS OIL SORBENT TYPE 356,
0456 ABSORPTION, WASTEWATER TREATMENT, EMULSIONS, PRECIPITATION, PATENT,
0489 ABSORPTION, OIL-WATER SEPARATION, ADSORPTION, PATENT, *SILICATE SORBENTS,
0668 ABSORPTION, ADSORPTION, BEHAVIOR, PLANKTON , *BENZENE,
0463 ACTIVATED SLUDGE, WASTEWATER TREATMENT, OIL INDUSTRY, PETROCHEMICALS, BIODEGRADATION, JAPAN,
0685 ACTIVATED SLUDGE, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, COST ANALYSIS,
0686 ACTIVATED SLUDGE, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, COST ANALYSIS,
0537 ACUTE EFFECTS, BIRDS, *SEABIRDS , MORTALITY, BEHAVIOR, OIL SLICKS, DISPERSANTS,
0556 ACUTE EFFECTS, TOXICITY, WSF, FUEL OIL, ZOOPLANKTON, MORTALITY,
0563 ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, METABOLISM, FISH, INVERTEBRATES, CHRONIC EFFECTS,
0580 ACUTE EFFECTS, CRUDE OIL, DISPERSANTS, EMULSIONS, CHRONIC EFFECTS, CRUSTACEANS, *COPEPODS, *TISBE BULBISETOSA,
0586 ACUTE EFFECTS, CRUDE OIL, FISH, TOXICITY, *MUGIL CEPHALUS,
R025 ACUTE EFFECTS, CHEMICAL ANALYSIS, OIL DISCHARGES, CHRONIC EFFECTS, SAMPLING, SEAWATER, SEDIMENTS, MARINE ORGANISMS, TOXICITY,
R045 ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, MORTALITY, SUBLETHAL EFFECTS, MARINE ORGANISMS, CHRONIC EFFECTS, ALASKA,
0371 ADSORPTION, PETROLEUM PRODUCTS, SOIL, CHEMICAL ANALYSIS,
0416 ADSORPTION, SPILL CLEANUP, PATENT *PINE PULP,
0417 ADSORPTION, SPILL CLEANUP, PATENT, *PINE CHIPS,
0425 ADSORPTION, SPILL CLEANUP, PATENT, *SORBENT FOAM,
0427 ADSORPTION, SEAWATER, PATENT, *RESIN FILAMENT,
0449 ADSORPTION, PETROCHEMICALS, INDUSTRIES, WASTEWATER TREATMENT, BIODEGRADATION, OXIDATION, *ACTIVATED CARBON,
0464 ADSORPTION, WASTE OIL TREATMENT, SPILL CLEANUP, SPILL DISPOSAL, PATENT, *MAGNETIC POWDER,
0466 ADSORPTION, WASTEWATER TREATMENT, OIL INDUSTRY, EQUIPMENT, *ACTIVATED CARBON,
0483 ADSORPTION, OIL-WATER SEPARATION, PATENT,
0484 ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, PATENT, *POLYETHLYLENE,
0486 ADSORPTION, OIL-WATER SEPARATION, WASTEWATERS, PATENT, *DIATOMITE, *ZEOLITE,
0489 ADSORPTION, ABSORPTION, OIL-WATER SEPARATION, PATENT, *SILICATE SORBENTS,
0490 ADSORPTION, OIL-WATER SEPARATION, PATENT, *FIBER SHEET, *TURBINE OIL,
0496 ADSORPTION, OIL-WATER SEPARATION, PATENT, *FIBERS,
0668 ADSORPTION, ABSORPTION, BEHAVIOR, PLANKTON , *BENZENE,
R034 ADSORPTION, WASTEWATER TREATMENT, REFINERIES, TOXICITY, *ACTIVATED CARBON, *BIOASSAY,
0314 AFRICA, CONTAMINATION, COASTS, POLLUTION CONTROL,
0350 ALASKA, SAMPLING, DISTRIBUTION, MOLLUSKS, BASELINE STUDIES, PORTS, INTERTIDAL ZONE, *MACOMA BALTHICA,
0435 ALASKA, OIL TRANSPORT, PIPELINES, TANKERS, ENVIRONMENTAL DETERIORATION, WATER QUALITY, US, EPA,
0507 ALASKA, PERSONNEL TRAINING, SPILL CLEANUP, EQUIPMENT, COMPENSATION, EPA, NOAA,
0572 ALASKA, BASELINE STUDIES, OIL TERMINALS, DISTRIBUTION, MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS, *MACOMA BALTHICA,
R033 ALASKA, PIPELINES, WATER QUALITY, MONITORING, STREAMS, FISH, BIOLOGICAL EFFECTS, *TAPS,
R043 ALASKA, CRUDE OIL, CONTAMINATION, MARSHES, ECOSYSTEMS, BASELINE STUDIES,
R045 ALASKA, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, MORTALITY, SUBLETHAL EFFECTS, MARINE ORGANISMS, CHRONIC EFFECTS,
0409 ALASKA/GULF OF, PRODUCT INFORMATION, SKIMMERS, SPILL RECOVERY, *CLEAN SWEEP SKIMMER,

R047 ALASKA/GULF OF, NATURAL SEEPAGE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, CHEMICAL EFFECTS, INTERTIDAL ZONE,
0547 ALGAE, WSF, CRUDE OIL, SUBLETHAL EFFECTS, *FUCUS SERRATUS, *ZYGOTE DEVELOPMENT,
0551 ALGAE, DISPERSANTS, BIOLOGICAL EFFECTS, TOXICITY, *COLLECTANTS,
0583 ALGAE, TOXICITY, FUEL OIL, WSF, GROWTH, *PHENALEN-1-ONE,
0584 ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, BIOLOGICAL EFFECTS, MORTALITY, BEHAVIOR, MICROORGANISMS, INVERTEBRATES,
0703 ALGAE, HYDROCARBONS , ZOOPLANKTON, BIOMASS, FOOD WEB, *BIOGENIC ORIGIN,
R048 ALGAE, HYDROCARBONS , DETECTION, TOXICITY, *BIOASSAY, *CULTURES,
0339 ANALYTICAL TECHNIQUES, REMOTE SENSING, OIL SPILLS, DETECTION, *BACKSCATTERING TECHNIQUES,
0356 ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, SURFACTANTS, HYDROCARBONS , DETECTION, SEAWATER,
0367 ANALYTICAL TECHNIQUES, CRUDE OIL, SEDIMENTS, DETECTION, SOURCE IDENTIFICATION, *THERMAL ANALYSIS,
0369 ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, SAMPLING, SOURCE IDENTIFICATION, BOOK REVIEW,
0373 ANALYTICAL TECHNIQUES, PRODUCT INFORMATION, *OIL-IN-WATER ANALYSIS, *PHOTOMETERS, *TELEDYNE,
0380 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, CONTAMINANTS, HYDROCARBONS , CHEMICAL ANALYSIS,
0454 ANALYTICAL TECHNIQUES, SHIPS, POLLUTION CONTROL, MONITORING, *ENZYME TECHNOLOGY,
0568 ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, DISPERSANTS, BOOK REVIEW, EUROPE,
0571 ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, DISPERSANTS, EUROPE, BOOK REVIEW,
0642 ANALYTICAL TECHNIQUES, BIODEGRADATION, CHEMICAL ANALYSIS, CRUDE OIL, MICROORGANISMS, *COMPARISONS,
0652 ANALYTICAL TECHNIQUES, CRUDE OIL, FUEL OIL, FATE, SEA SURFACE, CHEMICAL ANALYSIS,
R021 ANALYTICAL TECHNIQUES, MONITORING, MANUALS, SOURCE IDENTIFICATION, OIL SPILLS, EPA,
R026 ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, SEDIMENTS, SEAWATER, FRESHWATER, *IN SITU ANALYSIS,
0515 ARCTIC, GOVERNMENT AGENCIES, US, POLLUTION PREVENTION, SPILL CLEANUP, BLOWOUT PREVENTION, PIPELINES, ENVIRONMENTAL PROTECTION,
0541 ARCTIC, DISTRIBUTION, METABOLISM, *ABUNDANCE, BENTHOS, ECOSYSTEMS, USSR,
0566 ARCTIC, CRUDE OIL, OIL SPILLS, FRESHWATER, BIOLOGICAL EFFECTS, PLANKTON , CHRONIC EFFECTS, *INSECTS, *COASTAL TUNDRA PONDS,
0575 ARCTIC, CRUDE OIL, MARINE ORGANISMS, TOXICITY, WEATHERING, ICE, ECOSYSTEMS, SEDIMENTS,
0608 ARCTIC, HYDROCARBONS , PETROLEUM PRODUCTS, MARINE ORGANISMS, OCEANS, SUBARCTIC REGIONS, FATE, SOURCES,
0616 ARCTIC, GUIDELINES, OIL SPILLS, FATE, BEHAVIOR, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, *SCIENTIFIC RESPONSE STUDIES,
0657 ARCTIC, BEHAVIOR, CRUDE OIL, ICE, *OIL-ICE INTERACTIONS,
0659 ARCTIC, PHYSICAL EFFECTS, CHEMICAL EFFECTS, BIODEGRADATION, FATE, CRUDE OIL, MICROORGANISMS,
0663 ARCTIC, WEATHERING, OIL SPILLS, AROMATIC HYDROCARBONS, BIODEGRADATION, TOXICITY,
0665 ARCTIC, BEHAVIOR, CRUDE OIL, ICE, *OIL-IN-ICE,
0671 ARCTIC, BLOWOUTS, FATE, BEHAVIOR, *FLOW STRUCTURE,
R054 ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, METABOLISM, BASELINE STUDIES, DECOMPOSITION, SUBARCTIC REGIONS,
0617 ARGO MERCHANT SPILL, NOAA, CHRONIC EFFECTS, MARINE ORGANISMS, SEDIMENTS, FISH,
0660 ARGO MERCHANT SPILL, FATE, SOURCES, TORREY CANYON, *FLORIDA,
0684 ARGO MERCHANT SPILL, TANKERS, LIABILITY, INTERNATIONAL AGREEMENTS, COMPENSATION,
0360 AROMATIC HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, PAH,
0361 AROMATIC HYDROCARBONS, FUEL OIL, DETECTION, MOLLUSKS, UK, *MYTILUS EDULIS,
0485 AROMATIC HYDROCARBONS, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PETROCHEMICALS, FILTRATION ,
0544 AROMATIC HYDROCARBONS, UPTAKE, MARINE ORGANISMS, ZOOPLANKTON, *COPEPODS, *RADIOLABELED NAPHTHALENES,
0550 AROMATIC HYDROCARBONS, CARCINOGENS, PETROLEUM PRODUCTS, HEALTH HAZARDS,
0554 AROMATIC HYDROCARBONS, CRUDE OIL, UPTAKE, CHROMATOGRAPHY, SPECTROMETRY, BIRDS, *ANAS PLATYRHYNCHOS,
0647 AROMATIC HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, BACTERIA, SEDIMENTS, CHESAPEAKE BAY,
0661 AROMATIC HYDROCARBONS, FATE, BIODEGRADATION, CRUSTACEANS, PHYTOPLANKTON, SEDIMENTATION, *NAPHTHALENES,
0663 AROMATIC HYDROCARBONS, ARCTIC, WEATHERING, OIL SPILLS, BIODEGRADATION, TOXICITY,
0614 ATLANTIC COAST, PETROLEUM PRODUCTS, CONTAMINATION, FISH, FISHERIES, COASTS, *MIDDLE ATLANTIC BIGHT,
0653 ATLANTIC COAST, STATISTICAL ANALYSIS, OIL SPILLS, BEACHES, GEORGES BANK, USGS,
0340 ATLANTIC OCEAN, SAMPLING, TAR, OCEANS, NEUSTON, DISTRIBUTION, INDIAN OCEAN, *NEUSTONIC PERIPHYTON,
0344 ATLANTIC OCEAN, SAMPLING, TAR, CHROMATOGRAPHY, DISTRIBUTION, *COMPOSITION, *WEIGHT,
0354 ATLANTIC OCEAN, SAMPLING, HYDROCARBONS   *NOVA SCOTIA, *GULF STREAM, *BIOGENIC HYDROCARBONS,
0622 ATLANTIC OCEAN, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
0632 ATLANTIC OCEAN, OCS, OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
0634 ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, TANKERS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,

0635 ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, SAFETY, ENVIRONMENTAL EFFECTS.
0636 ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, DESIGN-ENGINEERING, POLLUTION PREVENTION, RESOURCE MANAGEMENT, *WORKSHOP,
0641 ATLANTIC OCEAN, BIODEGRADATION, CRUDE OIL, HYDROCARBONS , MICROORGANISMS, BACTERIA, SEDIMENTS, SEAWATER,
0662 ATLANTIC OCEAN, TAR, FATE, DISTRIBUTION, SEA SURFACE, SARGASSO SEA, *NORTH ATLANTIC,
0411 AUSTRALIA, SPILL CLEANUP, CONTINGENCY PLANNING, GOVERNMENT AGENCIES, OIL INDUSTRY, DISPERSANTS.
0413 BACTERIA, PETROLEUM PRODUCTS, SPILL CLEANUP, DISPERSANTS, SEAWATER, FRESHWATER, PATENT.
0545 BACTERIA, CRUDE OIL, FUEL OIL, TOXICITY, UPTAKE, METABOLISM, CANADA,
0640 BACTERIA, BIODEGRADATION, CHEMICAL ANALYSIS, STATISTICAL ANALYSIS, *TAXONOMY, *ECOLOGY, CHESAPEAKE BAY,
0641 BACTERIA, ATLANTIC OCEAN, BIODEGRADATION, CRUDE OIL, HYDROCARBONS , MICROORGANISMS, SEDIMENTS, SEAWATER,
0644 BACTERIA, BIODEGRADATION, HYDROCARBONS , SOIL, FUNGI, *LEAD.
0647 BACTERIA, AROMATIC HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, SEDIMENTS, CHESAPEAKE BAY,
0699 BACTERIA, CHEMICAL EFFECTS, MICROORGANISMS, METABOLISM, BIOLOGICAL EFFECTS, *BACTERIUM ALBUM, *PHENOL.
R055 BACTERIA, BIODEGRADATION, *MARINE PROTOZOA, *MICROSOMES.
0322 BALLAST , MONITORING, BILGES, SHIPS, DESIGN-ENGINEERING, DETECTION, PRODUCT INFORMATION, *OIL CONTENT ANALYSER,
0323 BALLAST , MONITORING, PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, *BABCOCK CONTROLS,
0441 BALLAST , TANKERS, DESIGN-ENGINEERING, IMCO, REGULATIONS, *COMPUTER METHODS.
0448 BALLAST , WASTEWATER TREATMENT, BILGES, TANKERS, *SHORE FACILITIES,
0470 BALLAST , OIL DISCHARGES, TANKERS, POLLUTION PREVENTION, SLUDGE , *CRUDE OIL WASHING,
0518 BALLAST , TANKERS, OIL TANKS, CRUDE OIL, POLLUTION PREVENTION, *LOAD-ON-TOP, *CRUDE OIL WASHING,
0319 BALTIC SEA, SAMPLING, STATISTICS, BIRDS, COASTS, POLAND,
0341 BALTIC SEA, SAMPLING, HYDROCARBONS , CHEMICAL ANALYSIS.
0559 BALTIC SEA, CRUDE OIL, MOLLUSKS, SUBLETHAL EFFECTS, BEHAVIOR.
0585 BALTIC SEA, BIOLOGICAL EFFECTS, BIRDS, MORTALITY, COASTS, POLAND, *CLANGULA HYEMALIS.
0613 BALTIC SEA, CONTAMINATION, CHRONIC EFFECTS, CHEMICAL EFFECTS, *OXYGEN DEFICIENCY.
0349 BASELINE STUDIES, SAMPLING, HYDROCARBONS , OCEANS, SEA SURFACE, *COASTAL WATERS, *SHIPPING LANES,
0350 BASELINE STUDIES, ALASKA, SAMPLING, DISTRIBUTION, MOLLUSKS, PORTS, INTERTIDAL ZONE, *MACOMA BALTHICA.
0572 BASELINE STUDIES, ALASKA, OIL TERMINALS, DISTRIBUTION, MOLLUSKS, INTERTIDAL ZONE, CHRONIC EFFECTS, *MACOMA BALTHICA.
0574 BASELINE STUDIES, METULA SPILL, ENVIRONMENTAL EFFECTS, CRUDE OIL, MARINE ORGANISMS, MORTALITY, MAGELLAN/STRAIT OF,
0679 BASELINE STUDIES, GUIDELINES, OFFSHORE DEVELOPMENT, OCS, OIL-GAS LEASING.
R043 BASELINE STUDIES, ALASKA, CRUDE OIL, CONTAMINATION, MARSHES, ECOSYSTEMS.
R054 BASELINE STUDIES, ARCTIC, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, METABOLISM, DECOMPOSITION, SUBARCTIC REGIONS.
0504 BEACHES, PERSONNEL TRAINING, SPILL CLEANUP, RESTORATION, COASTS, CANADA, *PRINCE EDWARD ISLAND, *SEMINAR.
0653 BEACHES, ATLANTIC COAST, STATISTICAL ANALYSIS, OIL SPILLS, GEORGES BANK, USGS.
0616 BEAUFORT SEA, ARCTIC, GUIDELINES, OIL SPILLS, FATE, BEHAVIOR, ENVIRONMENTAL EFFECTS, *SCIENTIFIC RESPONSE STUDIES,
0708 BEAUFORT SEA, ICE, *TOPOGRAPHY, SPILL CONTAINMENT,
0537 BEHAVIOR, ACUTE EFFECTS, BIRDS, *SEABIRDS , MORTALITY, OIL SLICKS, DISPERSANTS.
0559 BEHAVIOR, BALTIC SEA, CRUDE OIL, MOLLUSKS, SUBLETHAL EFFECTS.
0584 BEHAVIOR, ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, BIOLOGICAL EFFECTS, MORTALITY, MICROORGANISMS, INVERTEBRATES.
0589 BEHAVIOR, MOVEMENT, SPREADING, ICE, OIL SPILLS, FATE, MASSACHUSSETTS, *BUZZARDS BAY,
0609 BEHAVIOR, SOURCES, FATE, OIL SLICKS, OIL SPILLS, POLLUTION CONTROL, BIOLOGICAL EFFECTS, RED SEA,
0616 BEHAVIOR, BEAUFORT SEA, ARCTIC, GUIDELINES, OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, *SCIENTIFIC RESPONSE STUDIES,
0657 BEHAVIOR, ARCTIC, CRUDE OIL, ICE, *OIL-ICE INTERACTIONS,
0665 BEHAVIOR, ARCTIC, CRUDE OIL, ICE, *OIL-IN-ICE,
0668 BEHAVIOR, ADSORPTION, ABSORPTION, PLANKTON , *BENZENE.
0671 BEHAVIOR, ARCTIC, BLOWOUTS, FATE, *FLOW STRUCTURE.
R040 BEHAVIOR, HYDROCARBONS , MARINE ORGANISMS, SUBLETHAL EFFECTS, FUEL OIL, CHRONIC EFFECTS, *CHEMORECEPTION.
R041 BEHAVIOR, BIOLOGICAL EFFECTS, OIL SHALE, *DRILLING FLUIDS, CORALS, METABOLISM, MEXICO/GULF OF,
0352 BENTHOS, SAMPLING, HYDROCARBONS , SEDIMENTS, MARINE ORGANISMS, UPTAKE, FATE.
0541 BENTHOS, ARCTIC, DISTRIBUTION, METABOLISM, *ABUNDANCE, ECOSYSTEMS, USSR.
0576 BENTHOS, BIOLOGICAL EFFECTS, FATE, CONTAMINATION, PLANKTON , MODELS.
0629 BENTHOS, CONTAMINATION, REFINERIES, WASTEWATERS, CHRONIC EFFECTS.
0638 BENTHOS, FISH, HYDROCARBONS , CONTAMINATION, SEDIMENTS, *PETROLEUM TAINTS.

R049 BENTHOS, METULA SPILL, CONTAMINATION, SEDIMENTS, BIOLOGICAL EFFECTS, MAGELLAN/STRAIT OF,
0597 BIBLIOGRAPHIES, SOURCES, ENVIRONMENTAL EFFECTS, PETROLEUM PRODUCTS, CRUDE OIL, DETECTION, CHEMICAL ANALYSIS, MONITORING,
0685 BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, COST ANALYSIS,
0686 BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, COST ANALYSIS,
0687 BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, DESIGN-ENGINEERING, *OZONE,
0688 BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, EQUIPMENT, *OZONE,
0689 BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION, POLLUTION CONTROL, DESIGN-ENGINEERING, *MEMBRANES,
0690 BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION, POLLUTION CONTROL, DESIGN-ENGINEERING, *MEMBRANES,
0691 BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION, POLLUTION CONTROL, DESIGN-ENGINEERING, *MEMBRANES,
0692 BIBLIOGRAPHIES, ECONOMIC EFFECTS, WASTEWATER TREATMENT, GUIDELINES, STANDARDS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS,
0693 BIBLIOGRAPHIES, ECONOMICS, POLLUTION CONTROL, COST ANALYSIS, INDUSTRIES, WASTEWATER TREATMENT,
0694 BIBLIOGRAPHIES, SPILL CLEANUP, EQUIPMENT, OIL-WATER SEPARATION, SPREADING, DISPERSANTS,
0322 BILGES, BALLAST , MONITORING, SHIPS, DESIGN-ENGINEERING, DETECTION, PRODUCT INFORMATION, *OIL CONTENT ANALYSER,
0333 BILGES, MONITORING, SHIPS, DESIGN-ENGINEERING, DETECTION, *CARBON ANALYSIS,
0448 BILGES, BALLAST , WASTEWATER TREATMENT, TANKERS, *SHORE FACILITIES,
0453 BILGES, ULTRAFILTRATION, WASTEWATER TREATMENT, FUEL OIL, LUBRICATING OIL,
0475 BILGES, WASTEWATER TREATMENT, DESIGN-ENGINEERING, *PETROLEUM BARGES, *CLEANING FACILITIES,
0480 BILGES, OIL-WATER SEPARATION, FUELS , LUBRICATING OIL, FILTRATION , SHIPS,
0487 BILGES, OIL-WATER SEPARATION, WASTEWATERS, FILTRATION , PATENT, *POLYPROPYLENE FIBER,
0365 BIODEGRADATION, HYDROCARBONS , CHROMATOGRAPHY, MONITORING,
0447 BIODEGRADATION, WASTEWATER TREATMENT, WASTE OIL TREATMENT, OIL SPILLS, PETROCHEMICALS, MICROORGANISMS, INDUSTRIES,
0449 BIODEGRADATION, ADSORPTION, PETROCHEMICALS, INDUSTRIES, WASTEWATER TREATMENT, OXIDATION, *ACTIVATED CARBON,
0455 BIODEGRADATION, WASTE OIL TREATMENT, DISPOSAL , INDUSTRIES, WASTEWATER TREATMENT, RECLAMATION,
0463 BIODEGRADATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT, OIL INDUSTRY, PETROCHEMICALS, JAPAN,
0542 BIODEGRADATION, CRUDE OIL, HYDROCARBONS , CHEMICAL ANALYSIS, TANKERS, MICROORGANISMS,
0552 BIODEGRADATION, SPILL CLEANUP, BIOLOGICAL EFFECTS, FISH, UPTAKE, RELEASE, DISPERSANTS, CALIFORNIA,
0599 BIODEGRADATION, PETROLEUM PRODUCTS, CARCINOGENS, MORTALITY, SUBLETHAL EFFECTS, UPTAKE, RELEASE,
0640 BIODEGRADATION, BACTERIA, CHEMICAL ANALYSIS, STATISTICAL ANALYSIS, *TAXONOMY, *ECOLOGY, CHESAPEAKE BAY,
0641 BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, CRUDE OIL, HYDROCARBONS , MICROORGANISMS, SEDIMENTS, SEAWATER,
0642 BIODEGRADATION, ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, CRUDE OIL, MICROORGANISMS, *COMPARISONS,
0643 BIODEGRADATION, UPTAKE, FATE, *DEGRADATIVE CAPACITY,
0644 BIODEGRADATION, BACTERIA, HYDROCARBONS , SOIL, FUNGI, *LEAD,
0645 BIODEGRADATION, FUEL OIL, PHYTOPLANKTON, ZOOPLANKTON, DISTRIBUTION, ECOSYSTEMS,
0646 BIODEGRADATION, CRUDE OIL, FUELS , SEAWATER, MICROORGANISMS, POLLUTION CONTROL,
0647 BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, MICROORGANISMS, SEDIMENTS, CHESAPEAKE BAY,
0654 BIODEGRADATION, SOURCES, CONTAMINATION, FATE, SPILL CLEANUP, SINKING AGENTS, DISPERSANTS,
0656 BIODEGRADATION, HYDROCARBONS , SOIL, FATE,
0659 BIODEGRADATION, ARCTIC, PHYSICAL EFFECTS, CHEMICAL EFFECTS, FATE, CRUDE OIL, MICROORGANISMS,
0661 BIODEGRADATION, AROMATIC HYDROCARBONS, FATE, CRUSTACEANS, PHYTOPLANKTON, SEDIMENTATION, *NAPHTHALENES,
0663 BIODEGRADATION, AROMATIC HYDROCARBONS, ARCTIC, WEATHERING, OIL SPILLS, TOXICITY,
R042 BIODEGRADATION, BIOLOGICAL EFFECTS, ECOSYSTEMS, FRESHWATER, OIL SLICKS, MICROORGANISMS, *STABILITY,
R053 BIODEGRADATION, MICROORGANISMS, DISTRIBUTION, OCEANS,
R054 BIODEGRADATION, BASELINE STUDIES, ARCTIC, CRUDE OIL, MICROORGANISMS, METABOLISM, DECOMPOSITION, SUBARCTIC REGIONS,
R055 BIODEGRADATION, BACTERIA, *MARINE PROTOZOA, *MICROSOMES,
0530 BIOLOGICAL EFFECTS, BIRDS, CRUDE OIL, FUEL OIL, REPRODUCTION, *EGG HATCHABILITY,
0534 BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, SURFACTANTS, MICROORGANISMS,
0536 BIOLOGICAL EFFECTS, HYDROCARBONS , FUELS , FUEL OIL, MOLLUSKS, *MYTILUS EDULIS, *FOOD INTAKE,

0539 BIOLOGICAL EFFECTS, MOLLUSKS, MORTALITY, OIL SPILLS, MAINE, *CLAMS,
0548 BIOLOGICAL EFFECTS, FISH, SUBLETHAL EFFECTS, DISPERSANTS, SURFACTANTS,
0551 BIOLOGICAL EFFECTS, ALGAE, DISPERSANTS, TOXICITY, *COLLECTANTS,
0552 BIOLOGICAL EFFECTS, BIODEGRADATION, SPILL CLEANUP, FISH, UPTAKE, RELEASE, DISPERSANTS, CALIFORNIA,
0560 BIOLOGICAL EFFECTS, DISPERSANTS, MARINE ORGANISMS, ECHINODERMS, *SEA URCHIN EGGS, *FERTILIZATION, *BIO-INDICATORS,
0562 BIOLOGICAL EFFECTS, MARINE ORGANISMS, BOOK REVIEW,
0564 BIOLOGICAL EFFECTS, HYDROCARBONS , OCEANS, FATE, CHEMICAL ANALYSIS, *PROCEEDINGS ICES WORKSHOP,
0566 BIOLOGICAL EFFECTS, ARCTIC, CRUDE OIL, OIL SPILLS, FRESHWATER, PLANKTON , CHRONIC EFFECTS, *INSECTS, *COASTAL TUNDRA PONDS,
0576 BIOLOGICAL EFFECTS, BENTHOS, FATE, CONTAMINATION, PLANKTON , MODELS,
0578 BIOLOGICAL EFFECTS, HYDROCARBONS , FUELS, LAKES , *OUTBOARD MOTOR EXHAUST,
0581 BIOLOGICAL EFFECTS, FISH, MORTALITY, *MINNOWS, *GOLDFISH, *NORADRENALINE LEVELS, *BRAIN TISSUES,
0582 BIOLOGICAL EFFECTS, HYDROCARBONS , FISH, FOOD WEB, METABOLISM, UPTAKE, *HEXADECANE, *BENZO(A)PYRENE,
0584 BIOLOGICAL EFFECTS, BEHAVIOR, ALGAE, CRUDE OIL, PETROLEUM PRODUCTS, MORTALITY, MICROORGANISMS, INVERTEBRATES,
0585 BIOLOGICAL EFFECTS, BALTIC SEA, BIRDS, MORTALITY, COASTS, POLAND, *CLANGULA HYEMALIS,
0598 BIOLOGICAL EFFECTS, SOURCES, CRUDE OIL, HYDROCARBONS , FATE, PHYSICAL EFFECTS, CHEMICAL EFFECTS,
0601 BIOLOGICAL EFFECTS, HYDROCARBONS , SOURCES, SAMPLING, FATE, CHEMICAL ANALYSIS, *REVIEW,
0606 BIOLOGICAL EFFECTS, CONTAMINANTS, HYDROCARBONS , FATE, FISH, PACIFIC OCEAN, INDUSTRIES,
0609 BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES, FATE, OIL SLICKS, OIL SPILLS, POLLUTION CONTROL, RED SEA,
0618 BIOLOGICAL EFFECTS, OFFSHORE DRILLING, TOXICITY, MARINE ORGANISMS, *DRILLING MUDS,
0637 BIOLOGICAL EFFECTS, OFFSHORE DRILLING, TANKERS, PORTS, OIL TERMINALS, SOURCES, UK, NORTH SEA, *CELTIC SEA,
0699 BIOLOGICAL EFFECTS, BACTERIA, CHEMICAL EFFECTS, MICROORGANISMS, METABOLISM, *BACTERIUM ALBUM, *PHENOL,
0704 BIOLOGICAL EFFECTS, HEALTH HAZARDS, *MINERAL OIL,
R033 BIOLOGICAL EFFECTS, ALASKA, PIPELINES, WATER QUALITY, MONITORING, STREAMS, FISH, *TAPS,
R041 BIOLOGICAL EFFECTS, BEHAVIOR, OIL SHALE, *DRILLING FLUIDS, CORALS, METABOLISM, MEXICO/GULF OF,
R042 BIOLOGICAL EFFECTS, BIODEGRADATION, ECOSYSTEMS, FRESHWATER, OIL SLICKS, MICROORGANISMS, *STABILITY,
R044 BIOLOGICAL EFFECTS, HYDROCARBONS , TOXICITY, MARINE ORGANISMS, OCEANS, *BIO-INDICATORS,
R047 BIOLOGICAL EFFECTS, ALASKA/GULF OF, NATURAL SEEPAGE, CHRONIC EFFECTS, CHEMICAL EFFECTS, INTERTIDAL ZONE,
R049 BIOLOGICAL EFFECTS, BENTHOS, METULA SPILL, CONTAMINATION, SEDIMENTS, MAGELLAN/STRAIT OF,
R051 BIOLOGICAL EFFECTS, PETROCHEMICALS, MARINE ORGANISMS, TOXICITY, OFFSHORE DRILLING, EXTRACTION, OIL TRANSPORT, *DRILLING MUDS,
0703 BIOMASS, ALGAE, HYDROCARBONS , ZOOPLANKTON, FOOD WEB, *BIOGENIC ORIGIN,
0319 BIRDS, BALTIC SEA, SAMPLING, STATISTICS, COASTS, POLAND,
0429 BIRDS, RESTORATION, OIL SPILLS, MANUALS, *CARE & TREATMENT,
0430 BIRDS, RESTORATION, WILDLIFE, MANUALS, GUIDELINES, *OILED ANIMALS , *CARE & TREATMENT,
0530 BIRDS, BIOLOGICAL EFFECTS, CRUDE OIL, FUEL OIL, REPRODUCTION, *EGG HATCHABILITY,
0537 BIRDS, BEHAVIOR, ACUTE EFFECTS, *SEABIRDS , MORTALITY, OIL SLICKS, DISPERSANTS,
0554 BIRDS, AROMATIC HYDROCARBONS, CRUDE OIL, UPTAKE, CHROMATOGRAPHY, SPECTROMETRY, *ANAS PLATYRHYNCHOS,
0555 BIRDS, CRUDE OIL, HYDROCARBONS , CHROMATOGRAPHY, SPECTROMETRY, *ANAS PLATYRHYNCHOS,
0565 BIRDS, SUBLETHAL EFFECTS, CRUDE OIL, *HERRING GULL,
0579 BIRDS, CRUDE OIL, CHRONIC EFFECTS, SUBLETHAL EFFECTS, *INGESTION, *MALLARD DUCKS,
0585 BIRDS, BIOLOGICAL EFFECTS, BALTIC SEA, MORTALITY, COASTS, POLAND, *CLANGULA HYEMALIS,
0567 BLACK SEA, HYDROCARBONS , MOLLUSKS, UPTAKE, *MYTILUS GALLOPROVINCIALIS, *PARAFFINS,
0612 BLACK SEA, CONTAMINATION, PETROLEUM PRODUCTS, SEAWATER, *BULGARIA,
0515 BLOWOUT PREVENTION, ARCTIC, GOVERNMENT AGENCIES, US, POLLUTION PREVENTION, SPILL CLEANUP, PIPELINES, ENVIRONMENTAL PROTECTION,
0526 BLOWOUT PREVENTION, PRODUCT INFORMATION, SAFETY, *M&M 2000T SERIES NEEDLE VALVE,
0337 BLOWOUTS, REMOTE SENSING, OIL SLICKS, MONITORING, *NASA HEAT CAPACITY MAPPING MISSION,
0594 BLOWOUTS, POLLUTION PREVENTION, REGULATIONS, SAFETY, CONTINGENCY PLANNING, NORTH SEA, UK,
0671 BLOWOUTS, BEHAVIOR, ARCTIC, FATE, *FLOW STRUCTURE,
0369 BOOK REVIEW, ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, SAMPLING, SOURCE IDENTIFICATION,
0431 BOOK REVIEW, RESTORATION, OIL SPILLS, ECOSYSTEMS, *ECOLOGICAL DISASTERS,
0562 BOOK REVIEW, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
0568 BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, DISPERSANTS, EUROPE,
0571 BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, DISPERSANTS, EUROPE,
0676 BOOK REVIEW, POLLUTION CONTROL, CONTAMINANTS, LEGISLATION, INTERNATIONAL AGREEMENTS,
0383 BOOMS, SPILL CONTAINMENT, EQUIPMENT, PRODUCT INFORMATION, TANKERS, POLLUTION CONTROL, *LUCAN BOOM,
0385 BOOMS, SPILL CONTAINMENT, EQUIPMENT, PATENT,

0386 BOOMS, SPILL CONTAINMENT, PRODUCT INFORMATION, *BOA-BOOM II,
0388 BOOMS, SPILL CONTAINMENT, EQUIPMENT, PATENT,
0390 BOOMS, SPILL CONTAINMENT, POLLUTION CONTROL, EQUIPMENT, PRODUCT INFORMATION, *VATOR OY CO,
0414 BOOMS, SPILL CLEANUP, PATENT, *WATER SPRAY BOOMS ,
0419 BOOMS, SPILL CLEANUP, SPILL RECOVERY, HARBORS, SKIMMERS, EPA, *TESTS,
0422 BOOMS, PETROLEUM PRODUCTS, SPILL CLEANUP, EQUIPMENT, PATENT, *CRYOTHERMAL MATERIAL,
0428 BOOMS, SPILL CLEANUP, EQUIPMENT, PRODUCT INFORMATION, *VIKOMA OCEANPACK,
0509 BOOMS, PERSONNEL TRAINING, SPILL CLEANUP, PRODUCT INFORMATION, POLLUTION CONTROL, *VIKOMA OCEANPACK,
0552 CALIFORNIA, BIOLOGICAL EFFECTS, BIODEGRADATION, SPILL CLEANUP, FISH, UPTAKE, RELEASE, DISPERSANTS,
0590 CALIFORNIA, OIL SPILLS, ECONOMIC EFFECTS, MARINE ORGANISMS, COMPENSATION, *MONETARY VALUES,
0317 CANADA, OIL SPILLS, STATISTICS, INFORMATION SYSTEMS, *NATES,
0320 CANADA, OIL SLICKS, NATURAL SEEPAGE, SAMPLING, *BAFFIN ISLAND,
0372 CANADA, CHEMICAL ANALYSIS, WASTEWATERS, HYDROCARBONS , TAR SANDS, *OIL SANDS EXTRACTION PLANT,
0501 CANADA, PERSONNEL TRAINING, SPILL CLEANUP, COASTS, *ONSHORE CLEANUP,
0503 CANADA, PERSONNEL TRAINING, POLLUTION PREVENTION, CONTINGENCY PLANNING, OIL SPILLS, INLAND, INFORMATION SYSTEMS,
0504 CANADA, BEACHES, PERSONNEL TRAINING, SPILL CLEANUP, RESTORATION, COASTS, *PRINCE EDWARD ISLAND, *SEMINAR,
0510 CANADA, CONTINGENCY PLANNING, OIL SPILLS, SPILL CLEANUP, COASTS, INTERTIDAL ZONE,
0545 CANADA, BACTERIA, CRUDE OIL, FUEL OIL, TOXICITY, UPTAKE, METABOLISM,
0627 CANADA, ENVIRONMENTAL EFFECTS, REGULATIONS, OFFSHORE DRILLING, OCS, GOVERNMENT AGENCIES, *LABRADOR SEA,
0682 CANADA, INTERNATIONAL AGREEMENTS, GREAT LAKES, WATER QUALITY, US, POLLUTION CONTROL,
0343 CARCINOGENS, SAMPLING, CONTAMINATION, PAH, *CONTAMINANT REMOVAL,
0549 CARCINOGENS, PAH, HEALTH HAZARDS, FOOD WEB, CONTAMINATION, PETROLEUM PRODUCTS,
0550 CARCINOGENS, AROMATIC HYDROCARBONS, PETROLEUM PRODUCTS, HEALTH HAZARDS,
0599 CARCINOGENS, BIODEGRADATION, PETROLEUM PRODUCTS, MORTALITY, SUBLETHAL EFFECTS, UPTAKE, RELEASE,
0698 CARCINOGENS, PAH, CHEMICAL ANALYSIS,
0705 CARCINOGENS, WATER QUALITY, PAH, HEALTH HAZARDS, EXTRACTION, *CHLORINATION,
R046 CARCINOGENS, DETECTION, PETROLEUM PRODUCTS, OIL SHALE, FISH, *BIOASSAY,
0326 CHEMICAL ANALYSIS, MONITORING, DETECTION, POLLUTION CONTROL, DISPERSANTS, TOXICITY, *BIOASSAY,
0341 CHEMICAL ANALYSIS, BALTIC SEA, SAMPLING, HYDROCARBONS ,
0342 CHEMICAL ANALYSIS, SAMPLING, TAR, OCEANS, EQUIPMENT, *PLASTICS, *LITTER,
0356 CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SURFACTANTS, HYDROCARBONS , DETECTION, SEAWATER,
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0475 DESIGN-ENGINEERING, BILGES, WASTEWATER TREATMENT, *PETROLEUM BARGES, *CLEANING FACILITIES,
0511 DESIGN-ENGINEERING, TANKERS, POLLUTION PREVENTION, *ANTI-POLLUTION VALVE,
0512 DESIGN-ENGINEERING, MONITORING, OIL TANKS, POLLUTION PREVENTION, EQUIPMENT, PRODUCT INFORMATION, *OPTIC LIQUID LEVEL SENSOR,
0513 DESIGN-ENGINEERING, POLLUTION PREVENTION, TANKERS,
0636 DESIGN-ENGINEERING, ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, POLLUTION PREVENTION, RESOURCE MANAGEMENT, *WORKSHOP,
0674 DESIGN-ENGINEERING, LEGISLATION, TANKERS, SAFETY, US, REGULATIONS, SEGREGATED BALLAST,
0687 DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, *OZONE,
0689 DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION. POLLUTION CONTROL, *MEMBRANES,
0690 DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION, POLLUTION CONTROL, *MEMBRANES,
0691 DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, ULTRAFILTRATION. POLLUTION CONTROL, *MEMBRANES,
R032 DESIGN-ENGINEERING, PIPELINES, OFFSHORE DEVELOPMENT, POLLUTION PREVENTION,
R037 DESIGN-ENGINEERING, OIL-WATER SEPARATION, EQUIPMENT, *REVIEW.
R039 DESIGN-ENGINEERING, DETECTION, LEAKAGE, PIPELINES, INLAND, ENVIRONMENTAL PROTECTION, OFFSHORE DEVELOPMENT,
0315 DETECTION, HYDROCARBONS , POLLUTION CONTROL, ECUADOR,
0322 DETECTION, DESIGN-ENGINEERING, BILGES, BALLAST , MONITORING, SHIPS, PRODUCT INFORMATION, *OIL CONTENT ANALYSER,
0326 DETECTION, CHEMICAL ANALYSIS, MONITORING, POLLUTION CONTROL, DISPERSANTS, TOXICITY, *BIOASSAY,
0327 DETECTION, MONITORING, SAMPLING, PETROLEUM PRODUCTS, WASTEWATERS, PATENT,
0328 DETECTION, MONITORING, PETROLEUM PRODUCTS, POLLUTION PREVENTION, PATENT,
0329 DETECTION, MONITORING, EMULSIONS, *OIL IN WATER, PATENT, *PHOTOSENSOR,
0332 DETECTION, MONITORING, OIL SLICKS, *PASSIVE MICROWAVE IMAGER,
0333 DETECTION, DESIGN-ENGINEERING, BILGES, MONITORING, SHIPS, *CARBON ANALYSIS,
0334 DETECTION, MONITORING, FUEL OIL, SLUDGE, PATENT, *UV FLUORESCENCE,
0335 DETECTION, MONITORING, PRODUCT INFORMATION, EQUIPMENT, *INFRARED DETECTORS,
0338 DETECTION, REMOTE SENSING, DISPERSIONS, MONITORING, ESTUARIES,
0339 DETECTION, ANALYTICAL TECHNIQUES, REMOTE SENSING, OIL SPILLS, *BACKSCATTERING TECHNIQUES,
0346 DETECTION, COASTS, SAMPLING, NATURAL SEEPAGE, HYDROCARBONS , *TAIWAN,
0356 DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SURFACTANTS, HYDROCARBONS SEAWATER,
0361 DETECTION, AROMATIC HYDROCARBONS, FUEL OIL, MOLLUSKS, UK, *MYTILUS EDULIS,
0366 DETECTION, CONTAMINANTS, CHEMICAL ANALYSIS, ENVIRONMENTAL PROTECTION,
0367 DETECTION, CRUDE OIL, ANALYTICAL TECHNIQUES, SEDIMENTS, SOURCE IDENTIFICATION, *THERMAL ANALYSIS,
0378 DETECTION, SOURCE IDENTIFICATION, SPECTROSCOPY, *UV FLUORESCENCE,
0597 DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCES, ENVIRONMENTAL EFFECTS, PETROLEUM PRODUCTS, MONITORING,
0700 DETECTION, CHEMICAL ANALYSIS, HYDROCARBONS , *SULFUR DETERMINATION,
R022 DETECTION, MONITORING, OIL SPILLS, US, *ALARM SYSTEM,
R039 DETECTION, DESIGN-ENGINEERING, LEAKAGE, PIPELINES, INLAND, ENVIRONMENTAL PROTECTION, OFFSHORE DEVELOPMENT,
R046 DETECTION, CARCINOGENS, PETROLEUM PRODUCTS, OIL SHALE, FISH, *BIOASSAY,
R048 DETECTION, ALGAE, HYDROCARBONS , TOXICITY, *BIOASSAY, *CULTURES,
0331 DEVELOPMENT , MONITORING, OIL SHALE, GROUNDWATER, WATER QUALITY, ENVIRONMENTAL EFFECTS, *SURFACE MINING,

0519 DEVELOPMENT , POLLUTION CONTROL, OIL SHALE, EXTRACTION, WATER QUALITY, SOLID WASTES, EPA, *RESEARCH PROGRAMS,
0621 DEVELOPMENT , REFINERIES, EPA, VIRGINIA, *JAMES RIVER,
0626 DEVELOPMENT , CONTAMINATION, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, HEALTH HAZARDS, SOCIO-ECONOMIC EFFECTS, RESTORATION,
0326 DISPERSANTS, DETECTION, CHEMICAL ANALYSIS, MONITORING, POLLUTION CONTROL, TOXICITY, *BIOASSAY,
0398 DISPERSANTS, SKIMMERS, EQUIPMENT, EKOFISK BLOWOUT,
0402 DISPERSANTS, SPILL CLEANUP, PRODUCT INFORMATION,
0404 DISPERSANTS, SPILL CLEANUP, PATENT,
0411 DISPERSANTS, CONTINGENCY PLANNING, AUSTRALIA, SPILL CLEANUP, GOVERNMENT AGENCIES, OIL INDUSTRY,
0413 DISPERSANTS, BACTERIA, PETROLEUM PRODUCTS, SPILL CLEANUP, SEAWATER, FRESHWATER, PATENT,
0520 DISPERSANTS, SPILL CLEANUP, EQUIPMENT, INLAND, PETROLEUM PRODUCTS, *SORBENTS, PERSONNEL TRAINING, *FIRE-FIGHTING,
0537 DISPERSANTS, BIRDS, BEHAVIOR, ACUTE EFFECTS, *SEABIRDS , MORTALITY, OIL SLICKS,
0548 DISPERSANTS, BIOLOGICAL EFFECTS, FISH, SUBLETHAL EFFECTS, SURFACTANTS,
0551 DISPERSANTS, BIOLOGICAL EFFECTS, ALGAE, TOXICITY, *COLLECTANTS,
0552 DISPERSANTS, CALIFORNIA, BIOLOGICAL EFFECTS, BIODEGRADATION, SPILL CLEANUP, FISH, UPTAKE, RELEASE,
0560 DISPERSANTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ECHINODERMS, *SEA URCHIN EGGS, *FERTILIZATION, *BIO-INDICATORS,
0561 DISPERSANTS, ECHINODERMS, *SEA URCHINS, TOXICITY, PETROLEUM PRODUCTS, *BIO-INDICATORS,
0568 DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, EUROPE,
0571 DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS, EUROPE,
0580 DISPERSANTS, CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, ACUTE EFFECTS, EMULSIONS, *COPEPODS, *TISBE BULBISETOSA,
0654 DISPERSANTS, CONTAMINATION, BIODEGRADATION, SOURCES, FATE, SPILL CLEANUP, SINKING AGENTS,
0655 DISPERSANTS, OIL SLICKS, DISPERSIONS, FATE, UK,
0694 DISPERSANTS, BIBLIOGRAPHIES, SPILL CLEANUP, EQUIPMENT, OIL-WATER SEPARATION, SPREADING,
0338 DISPERSIONS, DETECTION, REMOTE SENSING, MONITORING, ESTUARIES,
0363 DISPERSIONS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS ,
0418 DISPERSIONS, SPILL RECOVERY, SURFACTANTS, TOXICITY,
0465 DISPERSIONS, COASTS, WASTEWATERS, DISPOSAL , REFINERIES, SPREADING, GREAT LAKES, MICHIGAN,
0655 DISPERSIONS, DISPERSANTS, OIL SLICKS, FATE, UK,
0672 DISPERSIONS, MODELS, SEDIMENTATION, HYDROCARBONS , FRESHWATER, *COAGULATION,
R024 DISPERSIONS, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, SAMPLING, *QUANTITATION,
R056 DISPERSIONS, OIL SLICKS, PHYSICAL EFFECTS, *LITERATURE SURVEY,
0436 DISPOSAL , STORAGE, MEXICO/GULF OF, LOUISIANA, *SALT DOMES, *BRINE DISCHARGE,
0445 DISPOSAL , WASTE OIL, RECLAMATION, RECYCLING, ECONOMICS, EPA, ENVIRONMENTAL EFFECTS,
0455 DISPOSAL , BIODEGRADATION, WASTE OIL TREATMENT, INDUSTRIES, WASTEWATER TREATMENT, RECLAMATION,
0465 DISPOSAL , DISPERSIONS, COASTS, WASTEWATERS, REFINERIES, SPREADING, GREAT LAKES, MICHIGAN,
0472 DISPOSAL , SOLID WASTES, OIL SHALE, TAR SANDS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, *SYNFUELS,
0482 DISTILLATION, OIL-WATER SEPARATION, SOLVENTS, PETROLEUM PRODUCTS, EXTRACTION, WASTEWATERS,
0340 DISTRIBUTION, ATLANTIC OCEAN, SAMPLING, TAR, OCEANS, NEUSTON, INDIAN OCEAN, *NEUSTONIC PERIPHYTON,
0344 DISTRIBUTION, CHROMATOGRAPHY, ATLANTIC OCEAN, SAMPLING, TAR, *COMPOSITION, *WEIGHT,
0345 DISTRIBUTION, CHROMATOGRAPHY, SAMPLING, HYDROCARBONS , SEA SURFACE, SEAWATER, SEDIMENTS, *N-ALKANES,
0350 DISTRIBUTION, BASELINE STUDIES, ALASKA, SAMPLING, MOLLUSKS, PORTS, INTERTIDAL ZONE, *MACOMA BALTHICA,
0541 DISTRIBUTION, BENTHOS, ARCTIC, METABOLISM, *ABUNDANCE, ECOSYSTEMS, USSR,
0572 DISTRIBUTION, CHRONIC EFFECTS, BASELINE STUDIES, ALASKA, OIL TERMINALS, MOLLUSKS, INTERTIDAL ZONE, *MACOMA BALTHICA,
0645 DISTRIBUTION, BIODEGRADATION, FUEL OIL, PHYTOPLANKTON, ZOOPLANKTON, ECOSYSTEMS,
0662 DISTRIBUTION, ATLANTIC OCEAN, TAR, FATE, SEA SURFACE, SARGASSO SEA, *NORTH ATLANTIC,
0666 DISTRIBUTION, CHROMATOGRAPHY, TAR, FATE, SOURCE IDENTIFICATION, WEATHERING, SARGASSO SEA,
R053 DISTRIBUTION, BIODEGRADATION, MICROORGANISMS, OCEANS,
0560 ECHINODERMS, DISPERSANTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, *SEA URCHIN EGGS, *FERTILIZATION, *BIO-INDICATORS,
0561 ECHINODERMS, DISPERSANTS, *SEA URCHINS, TOXICITY, PETROLEUM PRODUCTS, *BIO-INDICATORS,
0439 ECONOMIC EFFECTS, STORAGE, COST ANLYSIS, ENVIRONMENTAL EFFECTS, *STRATEGIC PETROLEUM RESERVE,
0590 ECONOMIC EFFECTS, COMPENSATION, CALIFORNIA, OIL SPILLS, MARINE ORGANISMS, *MONETARY VALUES,
0591 ECONOMIC EFFECTS, REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES, ILLINOIS, *HEXANES,
0605 ECONOMIC EFFECTS, COST ANALYSIS, FISHERIES, NORTH SEA, OIL SPILLS, OFFSHORE DEVELOPMENT,

0632 ECONOMIC EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS.
0634 ECONOMIC EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, TANKERS, ENVIRONMENTAL EFFECTS,
0692 ECONOMIC EFFECTS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, GUIDELINES, STANDARDS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS,
0445 ECONOMICS, DISPOSAL , WASTE OIL, RECLAMATION, RECYCLING, EPA, ENVIRONMENTAL EFFECTS,
0693 ECONOMICS, COST ANALYSIS, BIBLIOGRAPHIES, POLLUTION CONTROL, INDUSTRIES, WASTEWATER TREATMENT,
R036 ECONOMICS, WASTEWATER TREATMENT, OIL TANKS, REUSE, RECLAMATION, TOXICITY, *TANK TRUCK WASHING,
0431 ECOSYSTEMS, BOOK REVIEW, RESTORATION, OIL SPILLS, *ECOLOGICAL DISASTERS,
0541 ECOSYSTEMS, DISTRIBUTION, BENTHOS, ARCTIC, METABOLISM, *ABUNDANCE, USSR,
0575 ECOSYSTEMS, CRUDE OIL, ARCTIC, MARINE ORGANISMS, TOXICITY, WEATHERING, ICE, SEDIMENTS,
0595 ECOSYSTEMS, COASTS, ENVIRONMENTAL EFFECTS, SHORELINES, UK, MARINE ORGANISMS, TOXICITY,
0607 ECOSYSTEMS, OIL SPILLS, SHIPS, OIL DISCHARGES, WATER QUALITY, JAPAN, *TOKYO BAY,
0611 ECOSYSTEMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
0645 ECOSYSTEMS, DISTRIBUTION, BIODEGRADATION, FUEL OIL, PHYTOPLANKTON, ZOOPLANKTON,
0706 ECOSYSTEMS, RESOURCE MANAGEMENT, INDUSTRIES,
R042 ECOSYSTEMS, BIOLOGICAL EFFECTS, BIODEGRADATION, FRESHWATER, OIL SLICKS, MICROORGANISMS, *STABILITY,
R043 ECOSYSTEMS, CRUDE OIL, CONTAMINATION, BASELINE STUDIES, ALASKA, MARSHES,
R050 ECOSYSTEMS, HYDROCARBONS , INTERTIDAL ZONE, MORTALITY, GROWTH, UPTAKE, FATE, MOLLUSKS,
0315 ECUADOR, DETECTION, HYDROCARBONS , POLLUTION CONTROL,
0437 EIS, STORAGE, WATER QUALITY, SOCIO-ECONOMIC EFFECTS, *STRATEGIC PETROLEUM RESERVE,
0438 EIS, STORAGE, *STRATEGIC PETROLEUM RESERVE,
0623 EIS, OIL SPILLS, POLLUTION CONTROL, TANKERS, PLATFORMS, REFINERIES, PETROCHEMICALS, MANUALS, ENVIRONMENTAL PROTECTION,
0312 EKOFISK BLOWOUT, ENVIRONMENTAL EFFECTS, FATE, EVAPORATION, POLLUTION CONTROL,
0321 EKOFISK BLOWOUT, CRUDE OIL, SPILL CLEANUP, ENVIRONMENTAL EFFECTS, NORTH SEA, NORWAY,
0395 EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, NORTH SEA, EQUIPMENT, PRODUCT INFORMATION,
0398 EKOFISK BLOWOUT, DISPERSANTS, SKIMMERS, EQUIPMENT,
0399 EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, PRODUCT INFORMATION, NORTH SEA, *FRAMO SKIMMER,
0680 EKOFISK BLOWOUT, COMPENSATION, LIABILITY, INTERNATIONAL CONVENTIONS,
0543 EMULSIFIERS, CRUSTACEANS, SUBLETHAL EFFECTS, MORTALITY, MARINE ORGANISMS, *COPEPODS,
0329 EMULSIONS, DETECTION, MONITORING, *OIL IN WATER, PATENT, *PHOTOSENSOR,
0420 EMULSIONS, ABSORPTION, SPILL CLEANUP, POLLUTION PREVENTION, OIL TANKS, *DETERGENTS,
0446 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, FLOTATION, *ELECTROLYSIS,
0450 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
0452 EMULSIONS, WASTEWATER TREATMENT, SURFACTANTS, PATENT,
0456 EMULSIONS, ABSORPTION, WASTEWATER TREATMENT, PRECIPITATION, PATENT,
0460 EMULSIONS, WASTEWATER TREATMENT, REFINERIES, FLOTATION, FLOCCULATION, *COAGULATION,
0477 EMULSIONS, WASTEWATERS, WASTE OIL, FUELS , *COMBUSTION,
0492 EMULSIONS, OIL-WATER SEPARATION, FLOCCULATION, FILTRATION , INCINERATION, *COMPRESSOR DRAINS,
0493 EMULSIONS, OIL-WATER SEPARATION, FLOTATION, SURFACTANTS,
0580 EMULSIONS, DISPERSANTS, CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, ACUTE EFFECTS, *COPEPODS, *TISBE BULBISETOSA,
0649 EMULSIONS, CHEMICAL ANALYSIS, WEATHERING, FUEL OIL, SEAWATER,
0435 ENVIRONMENTAL DETERIORATION, ALASKA, OIL TRANSPORT, PIPELINES, TANKERS, WATER QUALITY, US, EPA,
0312 ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, FATE, EVAPORATION, POLLUTION CONTROL,
0316 ENVIRONMENTAL EFFECTS, INFORMATION SYSTEMS, STATISTICS, GUIDELINES, MODELS, NOAA,
0318 ENVIRONMENTAL EFFECTS, OIL SPILLS, STATISTICS, SPILL CLEANUP, *COMPUTER DIRECTORY,
0321 ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, CRUDE OIL, SPILL CLEANUP, NORTH SEA, NORWAY,
0331 ENVIRONMENTAL EFFECTS, DEVELOPMENT , MONITORING, OIL SHALE, GROUNDWATER, WATER QUALITY, *SURFACE MINING,
0434 ENVIRONMENTAL EFFECTS, PORTS, HARBORS, OIL TRANSFER, STATISTICS, POLLUTION CONTROL, UK, *MILFORD HAVEN,
0439 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, STORAGE, COST ANLYSIS, *STRATEGIC PETROLEUM RESERVE,
0445 ENVIRONMENTAL EFFECTS, ECONOMICS, DISPOSAL , WASTE OIL, RECLAMATION, RECYCLING, EPA,
0472 ENVIRONMENTAL EFFECTS, DISPOSAL , SOLID WASTES, OIL SHALE, TAR SANDS, POLLUTION CONTROL, *SYNFUELS,
0524 ENVIRONMENTAL EFFECTS, COST ANALYSIS, POLLUTION CONTROL, INDUSTRIES,
0574 ENVIRONMENTAL EFFECTS, CRUDE OIL, BASELINE STUDIES, METULA SPILL, MARINE ORGANISMS, MORTALITY, MAGELLAN/STRAIT OF,
0593 ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, HYDROCARBONS , MARINE ORGANISMS, SUBLETHAL EFFECTS, FATE, SOURCES, *SYMPOSIUM,
0595 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, COASTS, SHORELINES, UK, MARINE ORGANISMS, TOXICITY,
0597 ENVIRONMENTAL EFFECTS, DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCES, PETROLEUM PRODUCTS, MONITORING,
0604 ENVIRONMENTAL EFFECTS, SOURCES, OIL INDUSTRY, TANKERS, NATURAL SEEPAGE, WATER QUALITY, INLAND,
0611 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, HYDROCARBONS , FATE, POLLUTION CONTROL,

0615 ENVIRONMENTAL EFFECTS, OCEANS, HYDROCARBONS , MONITORING, POLLUTION CONTROL, UN,
0616 ENVIRONMENTAL EFFECTS, BEHAVIOR, BEAUFORT SEA, ARCTIC, GUIDELINES, OIL SPILLS, FATE, *SCIENTIFIC RESPONSE STUDIES,
0620 ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION, EPA, NEW JERSEY, MARYLAND,
0622 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DEVELOPMENT,
0626 ENVIRONMENTAL EFFECTS, DEVELOPMENT , CONTAMINATION, OIL SHALE, EXTRACTION, HEALTH HAZARDS, SOCIO-ECONOMIC EFFECTS, RESTORATION,
0627 ENVIRONMENTAL EFFECTS, CANADA, REGULATIONS, OFFSHORE DRILLING, OCS, GOVERNMENT AGENCIES, *LABRADOR SEA,
0630 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, NORTH SEA, UK,
0631 ENVIRONMENTAL EFFECTS, CRUDE OIL, LEGISLATION, POLLUTION CONTROL, *COASTAL ZONE MANAGEMENT, *CONFERENCE,
0632 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DEVELOPMENT,
0633 ENVIRONMENTAL EFFECTS, PORTS, SOCIO-ECONOMIC EFFECTS, ONSHORE EFFECTS, TEXAS, *SUPERPORTS ,
0634 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, TANKERS,
0635 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OCS, OFFSHORE DRILLING, SAFETY,
0692 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, GUIDELINES, STANDARDS, POLLUTION CONTROL,
R028 ENVIRONMENTAL EFFECTS, SPILL CLEANUP, EPA, *TESTING, *OHMSETT,
R052 ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING, EXTRACTION, FUEL OIL, OIL SHALE,
0366 ENVIRONMENTAL PROTECTION, DETECTION, CONTAMINANTS, CHEMICAL ANALYSIS,
0500 ENVIRONMENTAL PROTECTION, PERSONNEL TRAINING, OIL TRANSFER, REGULATIONS, USCG, *PERSONNEL QUALIFICATIONS,
0515 ENVIRONMENTAL PROTECTION, BLOWOUT PREVENTION, ARCTIC, GOVERNMENT AGENCIES, US, POLLUTION PREVENTION, SPILL CLEANUP, PIPELINES,
0528 ENVIRONMENTAL PROTECTION, POLLUTION PREVENTION, UN, MEDITERRANEAN SEA,
0623 ENVIRONMENTAL PROTECTION, EIS, OIL SPILLS, POLLUTION CONTROL, TANKERS, PLATFORMS, REFINERIES, PETROCHEMICALS, MANUALS,
0677 ENVIRONMENTAL PROTECTION, LEGISLATION, OFFSHORE DEVELOPMENT, *TREATY, *LAW OF SEA CONFERENCE,
R031 ENVIRONMENTAL PROTECTION, EQUIPMENT, MANUALS, SPILL CLEANUP, SHORELINES, RESTORATION, *FIELD METHODS,
R039 ENVIRONMENTAL PROTECTION, DETECTION, DESIGN-ENGINEERING, LEAKAGE, PIPELINES, INLAND, OFFSHORE DEVELOPMENT,
0336 EPA, REMOTE SENSING, MONITORING, OIL SPILLS, *LANDSAT, *ENVIRO-POD,
0419 EPA, BOOMS, SPILL CLEANUP, SPILL-RECOVERY, HARBORS, SKIMMERS, *TESTS,
0435 EPA, ENVIRONMENTAL DETERIORATION, ALASKA, OIL TRANSPORT, PIPELINES, TANKERS, WATER QUALITY, US,
0445 EPA, ENVIRONMENTAL EFFECTS, ECONOMICS, DISPOSAL , WASTE OIL, RECLAMATION, RECYCLING,
0507 EPA, COMPENSATION, ALASKA, PERSONNEL TRAINING, SPILL CLEANUP, EQUIPMENT, NOAA,
0519 EPA, DEVELOPMENT , POLLUTION CONTROL, OIL SHALE, EXTRACTION, WATER QUALITY, SOLID WASTES, *RESEARCH PROGRAMS,
0620 EPA, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION, NEW JERSEY, MARYLAND,
0621 EPA, DEVELOPMENT , REFINERIES, VIRGINIA, *JAMES RIVER,
0695 EPA, EQUIPMENT, *OHMSETT FACILITY,
R021 EPA, ANALYTICAL TECHNIQUES, MONITORING, MANUALS, SOURCE IDENTIFICATION, OIL SPILLS,
R027 EPA, SKIMMERS, SPILL RECOVERY, *TESTING, *OHMSETT,
R028 EPA, ENVIRONMENTAL EFFECTS, SPILL CLEANUP, *TESTING, *OHMSETT,
R029 EPA, SKIMMERS, SPILL CLEANUP, *TESTING, *OHMSETT,
0323 EQUIPMENT, BALLAST , MONITORING, PRODUCT INFORMATION, POLLUTION CONTROL, *BABCOCK CONTROLS,
0335 EQUIPMENT, DETECTION, MONITORING, PRODUCT INFORMATION, *INFRARED DETECTORS,
0342 EQUIPMENT, CHEMICAL ANALYSIS, SAMPLING, TAR, OCEANS, *PLASTICS, *LITTER,
0362 EQUIPMENT, CHEMICAL ANALYSIS, SPECTROSCOPY, PETROLEUM PRODUCTS,
0383 EQUIPMENT, BOOMS, SPILL CONTAINMENT, PRODUCT INFORMATION, TANKERS, POLLUTION CONTROL, *LUCAN BOOM,
0385 EQUIPMENT, BOOMS, SPILL CONTAINMENT, PATENT,
0388 EQUIPMENT, BOOMS, SPILL CONTAINMENT, PATENT,
0390 EQUIPMENT, BOOMS, SPILL CONTAINMENT, POLLUTION CONTROL, PRODUCT INFORMATION, *VATOR OY CO,
0393 EQUIPMENT, SKIMMERS, SPILL RECOVERY, UK, PRODUCT INFORMATION,
0394 EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PRODUCT INFORMATION, *EUROSKIMMER,
0395 EQUIPMENT, EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, NORTH SEA, PRODUCT INFORMATION,
0396 EQUIPMENT, DESIGN-ENGINEERING, SPILL RECOVERY, PRODUCT INFORMATION, *FIELD TESTING,
0398 EQUIPMENT, EKOFISK BLOWOUT, DISPERSANTS, SKIMMERS,
0400 EQUIPMENT, OIL-WATER SEPARATION, SKIMMERS, OIL TANKS, PRODUCT INFORMATION,
0403 EQUIPMENT, ABSORPTION, SPILL CLEANUP, PATENT, *POLYPROPYLENE,
0412 EQUIPMENT, SPILL CLEANUP, PATENT, *PLASTIC DISKS,
0422 EQUIPMENT, BOOMS, PETROLEUM PRODUCTS, SPILL CLEANUP, PATENT, *CRYOTHERMAL MATERIAL,
0428 EQUIPMENT, BOOMS, SPILL CLEANUP, PRODUCT INFORMATION, *VIKOMA OCEANPACK,
0466 EQUIPMENT, ADSORPTION, WASTEWATER TREATMENT, OIL INDUSTRY, *ACTIVATED CARBON,
0488 EQUIPMENT, OIL-WATER SEPARATION, PETROLEUM PRODUCTS, WASTEWATERS, FILTRATION , PATENT, *SEPARATION TANK,

0507 EQUIPMENT, EPA, COMPENSATION, ALASKA, PERSONNEL TRAINING, SPILL CLEANUP, NOAA,
0512 EQUIPMENT, DESIGN-ENGINEERING, MONITORING, OIL TANKS, POLLUTION PREVENTION, PRODUCT INFORMATION, *OPTIC LIQUID LEVEL SENSOR,
0520 EQUIPMENT, DISPERSANTS, SPILL CLEANUP, INLAND, PETROLEUM PRODUCTS, *SORBENTS, PERSONNEL TRAINING, *FIRE-FIGHTING,
0592 EQUIPMENT, REGULATIONS, POLLUTION CONTROL, USCG, IMCO, OIL INDUSTRY,
0688 EQUIPMENT, BIBLIOGRAPHIES, WASTEWATER TREATMENT, INDUSTRIES, POLLUTION CONTROL, *OZONE,
0694 EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, SPILL CLEANUP, OIL-WATER SEPARATION, SPREADING,
0695 EQUIPMENT, EPA, *OHMSETT FACILITY,
0702 EQUIPMENT, INDUSTRIES, POLLUTION CONTROL, WASTEWATERS,
R031 EQUIPMENT, MANUALS, SPILL CLEANUP, SHORELINES, ENVIRONMENTAL PROTECTION, RESTORATION, *FIELD METHODS,
R037 EQUIPMENT, DESIGN-ENGINEERING, OIL-WATER SEPARATION, *REVIEW,
0338 ESTUARIES, DISPERSIONS, DETECTION, REMOTE SENSING, MONITORING,
0670 ESTUARIES, MODELS, POLLUTION CONTROL, SOURCE IDENTIFICATION, SAMPLING,
0568 EUROPE, DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS,
0571 EUROPE, DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY, PETROLEUM PRODUCTS,
0312 EVAPORATION, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, FATE, POLLUTION CONTROL,
0648 EVAPORATION, HYDROCARBONS , TAR, MODELS, SEA SURFACE, WEATHERING,
0348 EXTRACTION, CONTAMINATION, SAMPLING, SEAWATER, *N-ALKANE ANALYSES,
0364 EXTRACTION, CHROMATOGRAPHY, PAH, *HPLC, *LITERATURE SURVEY,
0482 EXTRACTION, DISTILLATION, OIL-WATER SEPARATION, SOLVENTS, PETROLEUM PRODUCTS, WASTEWATERS,
0519 EXTRACTION, EPA, DEVELOPMENT , POLLUTION CONTROL, OIL SHALE, WATER QUALITY, SOLID WASTES, *RESEARCH PROGRAMS,
0626 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , CONTAMINATION, OIL SHALE, HEALTH HAZARDS, SOCIO-ECONOMIC EFFECTS, RESTORATION,
0705 EXTRACTION, CARCINOGENS, WATER QUALITY, PAH, HEALTH HAZARDS, *CHLORINATION,
R051 EXTRACTION, BIOLOGICAL EFFECTS, PETROCHEMICALS, MARINE ORGANISMS, TOXICITY, OFFSHORE DRILLING, OIL TRANSPORT, *DRILLING MUDS,
R052 EXTRACTION, ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING, FUEL OIL, OIL SHALE,
0312 FATE, EVAPORATION, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, POLLUTION CONTROL,
0352 FATE, BENTHOS, SAMPLING, HYDROCARBONS , SEDIMENTS, MARINE ORGANISMS, UPTAKE,
0564 FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, HYDROCARBONS , OCEANS, *PROCEEDINGS ICES WORKSHOP,
0576 FATE, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS, PLANKTON , MODELS,
0589 FATE, BEHAVIOR, MOVEMENT, SPREADING, ICE, OIL SPILLS, MASSACHUSSETTS, *BUZZARDS BAY,
0593 FATE, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, HYDROCARBONS , MARINE ORGANISMS, SUBLETHAL EFFECTS, SOURCES, *SYMPOSIUM,
0598 FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, SOURCES, HYDROCARBONS , PHYSICAL EFFECTS,
0601 FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, HYDROCARBONS , SOURCES, SAMPLING, *REVIEW,
0606 FATE, CONTAMINANTS, BIOLOGICAL EFFECTS, HYDROCARBONS , FISH, PACIFIC OCEAN, INDUSTRIES,
0608 FATE, ARCTIC, HYDROCARBONS , PETROLEUM PRODUCTS, MARINE ORGANISMS, OCEANS, SUBARCTIC REGIONS, SOURCES,
0609 FATE, BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES, OIL SLICKS, OIL SPILLS, POLLUTION CONTROL, RED SEA,
0611 FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, HYDROCARBONS , POLLUTION CONTROL,
0616 FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, BEAUFORT SEA, ARCTIC, GUIDELINES, OIL SPILLS, *SCIENTIFIC RESPONSE STUDIES,
0643 FATE, BIODEGRADATION, UPTAKE, *DEGRADATIVE CAPACITY,
0651 FATE, CRUDE OIL, CHROMATOGRAPHY, FUEL OIL, SEA SURFACE, SPECTROSCOPY, *REFRACTIVE INDEX,
0652 FATE, CRUDE OIL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, FUEL OIL, SEA SURFACE,
0654 FATE, DISPERSANTS, CONTAMINATION, BIODEGRADATION, SOURCES, SPILL CLEANUP, SINKING AGENTS,
0655 FATE, DISPERSIONS, DISPERSANTS, OIL SLICKS, UK,
0656 FATE, BIODEGRADATION, HYDROCARBONS , SOIL,
0658 FATE, CRUDE OIL, CHEMICAL ANALYSIS, HYDROCARBONS , WEATHERING, *PHOTODEGRADATION,
0659 FATE, CRUDE OIL, CHEMICAL EFFECTS, BIODEGRADATION, ARCTIC, PHYSICAL EFFECTS, MICROORGANISMS,
0660 FATE, ARGO MERCHANT SPILL, SOURCES, TORREY CANYON, *FLORIDA,
0661 FATE, CRUSTACEANS, BIODEGRADATION, AROMATIC HYDROCARBONS, PHYTOPLANKTON, SEDIMENTATION, *NAPHTHALENES,
0662 FATE, DISTRIBUTION, ATLANTIC OCEAN, TAR, SEA SURFACE, SARGASSO SEA, *NORTH ATLANTIC,
0664 FATE, DECOMPOSITION, TAR, SAMPLING, SARGASSO SEA, SOURCE IDENTIFICATION,
0666 FATE, DISTRIBUTION, CHROMATOGRAPHY, TAR, SOURCE IDENTIFICATION, WEATHERING, SARGASSO SEA,
0667 FATE, HYDROCARBONS , WEATHERING, PHYSICAL EFFECTS, *POLLUTANT TRANSFER,
0669 FATE, MODELS, SPILL CLEANUP, OIL SLICKS, *THEORETICAL PREDICTIONS,
0671 FATE, BLOWOUTS, BEHAVIOR, ARCTIC, *FLOW STRUCTURE,
R050 FATE, ECOSYSTEMS, HYDROCARBONS , INTERTIDAL ZONE, MORTALITY, GROWTH, UPTAKE, MOLLUSKS,
R057 FATE, OIL SHALE, WASTEWATERS, SOIL, MODELS, SOURCES, *POLLUTANT TRANSPORT,
0459 FILTRATION , WASTEWATER TREATMENT, OIL-WATER SEPARATION, *POLYURETHANE FOAM,

0471 FILTRATION , WASTEWATER TREATMENT, SURFACTANTS, PATENT,
0480 FILTRATION , BILGES, OIL-WATER SEPARATION, FUELS , LUBRICATING OIL, SHIPS,
0483 FILTRATION , AROMATIC HYDROCARBONS, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PETROCHEMICALS,
0487 FILTRATION , BILGES, OIL-WATER SEPARATION, WASTEWATERS, PATENT *POLYPROPYLENE FIBER,
0488 FILTRATION , EQUIPMENT, OIL-WATER SEPARATION, PETROLEUM PRODUCTS, WASTEWATERS, PATENT, *SEPARATION TANK,
0491 FILTRATION , OIL-WATER SEPARATION, WASTEWATERS, PATENT, *PVC MEMBRANE,
0492 FILTRATION , EMULSIONS, OIL-WATER SEPARATION, FLOCCULATION, INCINERATION, *COMPRESSOR DRAINS,
0325 FINLAND, COASTS, MONITORING, HYDROCARBONS , SEAWATER, SAMPLING,
0313 FISH, OIL SPILLS, FUEL OIL, MORTALITY, SPILL CLEANUP, *ADRIAN MAERSK, *HONG KONG,
0347 FISH, COASTS, SAMPLING, HYDROCARBONS , INVERTEBRATES, SEDIMENTS, GREENLAND,
0353 FISH, CHROMATOGRAPHY, SAMPLING, HYDROCARBONS , PLANKTON , INVERTEBRATES, UK, *N-ALKANES,
0540 FISH, CRUDE OIL, *BENZENE, METABOLISM, GROWTH, *CLUPEA HARENGUS PALLASI, *EMBRYOS, *LARVAE,
0546 FISH, CRUSTACEANS, HYDROCARBONS , TOXICITY, METABOLISM, MARINE ORGANISMS, MOLLUSKS, *XENOBIOTIC CHEMICALS,
0548 FISH, DISPERSANTS, BIOLOGICAL EFFECTS, SUBLETHAL EFFECTS, SURFACTANTS,
0552 FISH, DISPERSANTS, CALIFORNIA, BIOLOGICAL EFFECTS, BIODEGRADATION, SPILL CLEANUP, UPTAKE, RELEASE,
0563 FISH, CHRONIC EFFECTS, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, METABOLISM, INVERTEBRATES,
0581 FISH, BIOLOGICAL EFFECTS, MORTALITY, *MINNOWS, *GOLDFISH, *NORADRENALINE LEVELS, *BRAIN TISSUES,
0582 FISH, BIOLOGICAL EFFECTS, HYDROCARBONS , FOOD WEB, METABOLISM, UPTAKE, *HEXADECANE, *BENZO(A)PYRENE,
0586 FISH, CRUDE OIL, ACUTE EFFECTS, TOXICITY, *MUGIL CEPHALUS,
0606 FISH, FATE, CONTAMINANTS, BIOLOGICAL EFFECTS, HYDROCARBONS , PACIFIC OCEAN, INDUSTRIES,
0614 FISH, CONTAMINATION, COASTS, ATLANTIC COAST, PETROLEUM PRODUCTS, FISHERIES, *MIDDLE ATLANTIC BIGHT,
0617 FISH, CHRONIC EFFECTS, ARGO MERCHANT SPILL, NOAA, MARINE ORGANISMS, SEDIMENTS,
0638 FISH, CONTAMINATION, BENTHOS, HYDROCARBONS , SEDIMENTS, *PETROLEUM TAINTS,
R033 FISH, BIOLOGICAL EFFECTS, ALASKA, PIPELINES, WATER QUALITY, MONITORING, STREAMS, *TAPS,
R046 FISH, DETECTION, CARCINOGENS, PETROLEUM PRODUCTS, OIL SHALE, *BIOASSAY,
0587 FISHERIES, CONTAMINATION, CHROMATOGRAPHY, MOLLUSKS, RELEASE, METABOLISM, *MUSSEL CULTURES,
0605 FISHERIES, ECONOMIC EFFECTS, COST ANALYSIS, NORTH SEA, OIL SPILLS, OFFSHORE DEVELOPMENT,
0614 FISHERIES, FISH, CONTAMINATION, COASTS, ATLANTIC COAST, PETROLEUM PRODUCTS, *MIDDLE ATLANTIC BIGHT,
0625 FISHERIES, COMPENSATION, OIL-GAS LEASING, LEGISLATION, LIABILITY, OCS, GEORGES BANK,
0460 FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, FLOTATION, *COAGULATION,
0492 FLOCCULATION, FILTRATION , EMULSIONS, OIL-WATER SEPARATION, INCINERATION, *COMPRESSOR DRAINS,
0495 FLOCCULATION, OIL-WATER SEPARATION, WASTEWATERS, PATENT, *THIOLIGNIN ACID,
0446 FLOTATION, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, *ELECTROLYSIS,
0460 FLOTATION, FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, *COAGULATION,
0474 FLOTATION, WASTEWATER TREATMENT, REFINERIES, SEDIMENTATION,
0493 FLOTATION, EMULSIONS, OIL-WATER SEPARATION, SURFACTANTS,
0549 FOOD WEB, CONTAMINATION, CARCINOGENS, PAH, HEALTH HAZARDS, PETROLEUM PRODUCTS,
0569 FOOD WEB, CONTAMINATION, HYDROCARBONS , SARGASSO SEA, *TRANSFER , *BIOGENIC HYDROCARBONS,
0582 FOOD WEB, FISH, BIOLOGICAL EFFECTS, HYDROCARBONS , METABOLISM, UPTAKE, *HEXADECANE, *BENZO(A)PYRENE,
0703 FOOD WEB, BIOMASS, ALGAE, HYDROCARBONS , ZOOPLANKTON, *BIOGENIC ORIGIN,
0588 FRANCE, CONTAMINATION, OIL SPILLS, FUEL OIL, MOLLUSKS, UPTAKE, RELEASE, *PORT DE BOUC SPILL, *MUSSELS,
0413 FRESHWATER, DISPERSANTS, BACTERIA, PETROLEUM PRODUCTS, SPILL CLEANUP, SEAWATER, PATENT,
0566 FRESHWATER, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ARCTIC, OIL SPILLS, PLANKTON , *INSECTS, *COASTAL TUNDRA PONDS,
0650 FRESHWATER, PHYSICAL EFFECTS, MOVEMENT, HYDROCARBONS , WASTEWATERS, GROUNDWATER, *AQUIFER,
0672 FRESHWATER, DISPERSIONS, MODELS, SEDIMENTATION, HYDROCARBONS , *COAGULATION,
R026 FRESHWATER, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, SEDIMENTS, SEAWATER, *IN SITU ANALYSIS,
R030 FRESHWATER, SPILL RECOVERY, OCEANS, POLLUTION PREVENTION, *AMINE CARBAMATE GELATION TECHNIQUES,
R042 FRESHWATER, ECOSYSTEMS, BIOLOGICAL EFFECTS, BIODEGRADATION, OIL SLICKS, MICROORGANISMS, *STABILITY,
0313 FUEL OIL, FISH, OIL SPILLS, MORTALITY, SPILL CLEANUP, *ADRIAN MAERSK, *HONG KONG,
0334 FUEL OIL, DETECTION, MONITORING, SLUDGE, PATENT, *UV FLUORESCENCE,
0361 FUEL OIL, DETECTION, AROMATIC HYDROCARBONS, MOLLUSKS, UK, *MYTILUS EDULIS,
0401 FUEL OIL, ABSORPTION, SPILL CLEANUP, *POLYURETHANE FOAM,

0440 FUEL OIL, PETROLEUM PRODUCTS, STORAGE, OIL TRANSPORT, REFINING, OIL SPILLS, FUELS
0453 FUEL OIL, BILGES, ULTRAFILTRATION, WASTEWATER TREATMENT, LUBRICATING OIL,
0497 FUEL OIL, WASTE OIL, RECLAMATION, RECYCLING, WASTEWATER TREATMENT, *CENTRIFUGATION,
0529 FUEL OIL, CRUSTACEANS, CHRONIC EFFECTS, OIL SPILLS, MARSHES, TOXICITY, MASSACHUSETTS, *UCA PAGNAX,
0530 FUEL OIL, CRUDE OIL, BIRDS, BIOLOGICAL EFFECTS, REPRODUCTION, *EGG HATCHABILITY,
0532 FUEL OIL, CRUDE OIL, MARINE ORGANISMS, METABOLISM, REPRODUCTION, GROWTH,
0535 FUEL OIL, CRUDE OIL, TOXICITY, WSF, WASTE OIL, MOLLUSKS, MORTALITY, *MERCENARIA,
0536 FUEL OIL, BIOLOGICAL EFFECTS, HYDROCARBONS , FUELS , MOLLUSKS, *MYTILUS EDULIS, *FOOD INTAKE,
0545 FUEL OIL, CRUDE OIL, CANADA, BACTERIA, TOXICITY, UPTAKE, METABOLISM,
0556 FUEL OIL, ACUTE EFFECTS, TOXICITY, WSF, ZOOPLANKTON, MORTALITY,
0557 FUEL OIL, CRUSTACEANS, CRUDE OIL, TOXICITY, MORTALITY, WSF, *AMPHIPODS,
0577 FUEL OIL, CRUDE OIL, WSF, TOXICITY, SUBLETHAL EFFECTS, POLYCHAETES, *NEANTHES ARENACEODENTATA,
0583 FUEL OIL, ALGAE, TOXICITY, WSF, GROWTH, *PHENALEN-1-ONE,
0588 FUEL OIL, FRANCE, CONTAMINATION, OIL SPILLS, MOLLUSKS, UPTAKE, RELEASE, *PORT DE BOUC SPILL, *MUSSELS,
0645 FUEL OIL, ECOSYSTEMS, DISTRIBUTION, BIODEGRADATION, PHYTOPLANKTON, ZOOPLANKTON,
0649 FUEL OIL, EMULSIONS, CHEMICAL ANALYSIS, WEATHERING, SEAWATER,
0651 FUEL OIL, FATE, CRUDE OIL, CHROMATOGRAPHY, SEA SURFACE, SPECTROSCOPY, *REFRACTIVE INDEX,
0652 FUEL OIL, FATE, CRUDE OIL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SEA SURFACE,
R040 FUEL OIL, CHRONIC EFFECTS, BEHAVIOR, HYDROCARBONS , MARINE ORGANISMS, SUBLETHAL EFFECTS, *CHEMORECEPTION,
R052 FUEL OIL, EXTRACTION, ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING, OIL SHALE,
0381 FUELS , CRUDE OIL, CHROMATOGRAPHY, SOURCE IDENTIFICATION,
0440 FUELS , FUEL OIL, PETROLEUM PRODUCTS, STORAGE, OIL TRANSPORT, REFINING, OIL SPILLS,
0477 FUELS , EMULSIONS, WASTEWATERS, WASTE OIL, *COMBUSTION,
0480 FUELS , FILTRATION , BILGES, OIL-WATER SEPARATION, LUBRICATING OIL, SHIPS,
0536 FUELS , FUEL OIL, BIOLOGICAL EFFECTS, HYDROCARBONS , MOLLUSKS, *MYTILUS EDULIS, *FOOD INTAKE,
0646 FUELS , CRUDE OIL, BIODEGRADATION, SEAWATER, MICROORGANISMS, POLLUTION CONTROL,
0644 FUNGI, BIODEGRADATION, BACTERIA, HYDROCARBONS , SOIL, *LEAD,
0625 GEORGES BANK, FISHERIES, COMPENSATION, OIL-GAS LEASING, LEGISLATION, LIABILITY, OCS,
0653 GEORGES BANK, BEACHES, ATLANTIC COAST, STATISTICAL ANALYSIS, OIL SPILLS, USGS,
0411 GOVERNMENT AGENCIES, DISPERSANTS, CONTINGENCY PLANNING, AUSTRALIA, SPILL CLEANUP, OIL INDUSTRY,
0515 GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, BLOWOUT PREVENTION, ARCTIC, US, POLLUTION PREVENTION, SPILL CLEANUP, PIPELINES,
0627 GOVERNMENT AGENCIES, ENVIRONMENTAL EFFECTS, CANADA, REGULATIONS, OFFSHORE DRILLING, OCS, *LABRADOR SEA,
0707 GOVERNMENT AGENCIES, INDUSTRIES, POLLUTION CONTROL, REGULATIONS,
0465 GREAT LAKES, DISPOSAL , DISPERSIONS, COASTS, WASTEWATERS, REFINERIES, SPREADING, MICHIGAN,
0682 GREAT LAKES, CANADA, INTERNATIONAL AGREEMENTS, WATER QUALITY, US, POLLUTION CONTROL,
0347 GREENLAND, FISH, COASTS, SAMPLING, HYDROCARBONS , INVERTEBRATES, SEDIMENTS,
0331 GROUNDWATER, ENVIRONMENTAL EFFECTS, DEVELOPMENT , MONITORING, OIL SHALE, WATER QUALITY, *SURFACE MINING,
0462 GROUNDWATER, HYDROCARBONS , SOIL, WASTEWATER TREATMENT, POLLUTION CONTROL, *FUEL DEPOTS,
0650 GROUNDWATER, FRESHWATER, PHYSICAL EFFECTS, MOVEMENT, HYDROCARBONS , WASTEWATERS, *AQUIFER,
0673 GROUNDWATER, CONTAMINATION, MODELS, PETROLEUM PRODUCTS, *HYDRODYNAMICS,
0532 GROWTH, FUEL OIL, CRUDE OIL, MARINE ORGANISMS, METABOLISM, REPRODUCTION,
0540 GROWTH, FISH, CRUDE OIL, *BENZENE, METABOLISM, *CLUPEA HARENGUS PALLASI, *EMBRYOS, *LARVAE,
0558 GROWTH, WSF, HYDROCARBONS , TOXICITY, MOLLUSKS, *MUSSEL LARVAE,
0583 GROWTH, FUEL OIL, ALGAE, TOXICITY, WSF, *PHENALEN-1-ONE,
R050 GROWTH, FATE, ECOSYSTEMS, HYDROCARBONS , INTERTIDAL ZONE, MORTALITY, UPTAKE, MOLLUSKS,
0316 GUIDELINES, ENVIRONMENTAL EFFECTS, INFORMATION SYSTEMS, STATISTICS, MODELS, NOAA,
0430 GUIDELINES, BIRDS, RESTORATION, WILDLIFE, MANUALS, *OILED ANIMALS , *CARE & TREATMENT,
0616 GUIDELINES, FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, BEAUFORT SEA, ARCTIC, OIL SPILLS, *SCIENTIFIC RESPONSE STUDIES,
0678 GUIDELINES, POLLUTION PREVENTION, WASTEWATERS, OIL TERMINALS, SAFETY, *FLOATING RECEPTION FACILITIES,
0679 GUIDELINES, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, OIL-GAS LEASING,
0692 GUIDELINES, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, STANDARDS, POLLUTION CONTROL,
0419 HARBORS, EPA, BOOMS, SPILL CLEANUP, SPILL RECOVERY, SKIMMERS, *TESTS,
0434 HARBORS, ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSFER, STATISTICS, POLLUTION CONTROL, UK, *MILFORD HAVEN,
0538 HEALTH HAZARDS, MICROORGANISMS, POLLUTION CONTROL, *MICROBIOLOGICAL ASPECTS,
0549 HEALTH HAZARDS, FOOD WEB, CONTAMINATION, CARCINOGENS, PAH, PETROLEUM PRODUCTS,
0550 HEALTH HAZARDS, CARCINOGENS, AROMATIC HYDROCARBONS, PETROLEUM PRODUCTS,

0626 HEALTH HAZARDS, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , CONTAMINATION, OIL SHALE, SOCIO-ECONOMIC EFFECTS, RESTORATION,
0704 HEALTH HAZARDS, BIOLOGICAL EFFECTS, *MINERAL OIL,
0705 HEALTH HAZARDS, EXTRACTION, CARCINOGENS, WATER QUALITY, PAH, *CHLORINATION,
0315 HYDROCARBONS , ECUADOR, DETECTION, POLLUTION CONTROL,
0325 HYDROCARBONS , FINLAND, COASTS, MONITORING, SEAWATER, SAMPLING,
0341 HYDROCARBONS , CHEMICAL ANALYSIS, BALTIC SEA, SAMPLING,
0345 HYDROCARBONS , DISTRIBUTION, CHROMATOGRAPHY, SAMPLING, SEA SURFACE, SEAWATER, SEDIMENTS, *N-ALKANES,
0346 HYDROCARBONS , DETECTION, COASTS, SAMPLING, NATURAL SEEPAGE, *TAIWAN,
0347 HYDROCARBONS , GREENLAND, FISH, COASTS, SAMPLING, INVERTEBRATES, SEDIMENTS,
0349 HYDROCARBONS , BASELINE STUDIES, SAMPLING, OCEANS, SEA SURFACE, *COASTAL WATERS, *SHIPPING LANES,
0351 HYDROCARBONS , SAMPLING, WASTEWATERS, OIL FIELDS, *ORGANIC COMPOUNDS,
0352 HYDROCARBONS , FATE, BENTHOS, SAMPLING, SEDIMENTS, MARINE ORGANISMS, UPTAKE,
0353 HYDROCARBONS , FISH, CHROMATOGRAPHY, SAMPLING, PLANKTON , INVERTEBRATES, UK, *N-ALKANES,
0354 HYDROCARBONS , ATLANTIC OCEAN, SAMPLING, *NOVA SCOTIA, *GULF STREAM, *BIOGENIC HYDROCARBONS,
0355 HYDROCARBONS , CHROMATOGRAPHY, STANDARDIZATION METHODS,
0356 HYDROCARBONS , DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SURFACTANTS, SEAWATER,
0357 HYDROCARBONS , CHEMICAL ANALYSIS, MARINE ORGANISMS,
0359 HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, MARINE ORGANISMS, *BIOGENIC HYDROCARBONS,
0363 HYDROCARBONS , DISPERSIONS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
0365 HYDROCARBONS , CHROMATOGRAPHY, BIODEGRADATION, MONITORING,
0372 HYDROCARBONS , CHEMICAL ANALYSIS, CANADA, WASTEWATERS, TAR SANDS, *OIL SANDS EXTRACTION PLANT,
0377 HYDROCARBONS , SOURCE IDENTIFICATION, PRODUCTION , MEXICO/GULF OF, MISSISSIPPI RIVER,
0380 HYDROCARBONS , CONTAMINANTS, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION,
0462 HYDROCARBONS , GROUNDWATER, SOIL, WASTEWATER TREATMENT, POLLUTION CONTROL, *FUEL DEPOTS,
0522 HYDROCARBONS , CHRONIC EFFECTS, MEDITERRANEAN SEA, TAR, TANKERS, SOURCES, POLLUTION CONTROL,
0533 HYDROCARBONS , MARINE ORGANISMS, CHEMICAL ANALYSIS, TOXICITY, UPTAKE, RELEASE, WSF,
0536 HYDROCARBONS , FUELS , FUEL OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *MYTILUS EDULIS, *FOOD INTAKE,
0542 HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, BIODEGRADATION, TANKERS, MICROORGANISMS,
0546 HYDROCARBONS , FISH, CRUSTACEANS, TOXICITY, METABOLISM, MARINE ORGANISMS, MOLLUSKS, *XENOBIOTIC CHEMICALS,
0555 HYDROCARBONS , CRUDE OIL, CHROMATOGRAPHY, BIRDS, SPECTROMETRY, *ANAS PLATYRHYNCHOS,
0558 HYDROCARBONS , GROWTH, WSF, TOXICITY, MOLLUSKS, *MUSSEL LARVAE,
0564 HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, OCEANS, *PROCEEDINGS ICES WORKSHOP,
0567 HYDROCARBONS , BLACK SEA, MOLLUSKS, UPTAKE, *MYTILUS GALLOPROVINCIALIS, *PARAFFINS,
0569 HYDROCARBONS , FOOD WEB, CONTAMINATION, SARGASSO SEA, *TRANSFER , *BIOGENIC HYDROCARBONS,
0570 HYDROCARBONS , CHROMATOGRAPHY, SAMPLING, MOLLUSKS, SEDIMENTS, *PECTEN YESSOENSIS,
0578 HYDROCARBONS , BIOLOGICAL EFFECTS, FUELS, LAKES , *OUTBOARD MOTOR EXHAUST,
0582 HYDROCARBONS , FOOD WEB, FISH, BIOLOGICAL EFFECTS, METABOLISM, UPTAKE, *HEXADECANE, *BENZO(A)PYRENE,
0593 HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, MARINE ORGANISMS, SUBLETHAL EFFECTS, SOURCES, *SYMPOSIUM,
0598 HYDROCARBONS , BIOLOGICAL EFFECTS, SOURCES, CRUDE OIL, FATE, PHYSICAL EFFECTS, CHEMICAL EFFECTS,
0600 HYDROCARBONS , PETROLEUM PRODUCTS, OIL TRANSPORT, OCEANS, SEA SURFACE, *AIR-SEA INTERFACE,
0601 HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SOURCES, SAMPLING, *REVIEW,
0606 HYDROCARBONS , FISH, FATE, CONTAMINANTS, BIOLOGICAL EFFECTS, PACIFIC OCEAN, INDUSTRIES,
0608 HYDROCARBONS , FATE, ARCTIC, PETROLEUM PRODUCTS, MARINE ORGANISMS, OCEANS, SUBARCTIC REGIONS, SOURCES,
0610 HYDROCARBONS , CHRONIC EFFECTS, MARINE ORGANISMS, TOXICITY, *TOXICOLOGICAL RESEARCH,
0611 HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, POLLUTION CONTROL,
0615 HYDROCARBONS , ENVIRONMENTAL EFFECTS, OCEANS, MONITORING, POLLUTION CONTROL, UN,
0638 HYDROCARBONS , FISH, CONTAMINATION, BENTHOS, SEDIMENTS, *PETROLEUM TAINTS,
0641 HYDROCARBONS , CRUDE OIL, BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, MICROORGANISMS, SEDIMENTS, SEAWATER,
0644 HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, SOIL, *LEAD,
0648 HYDROCARBONS , EVAPORATION, TAR, MODELS, SEA SURFACE, WEATHERING,
0650 HYDROCARBONS , GROUNDWATER, FRESHWATER, PHYSICAL EFFECTS, MOVEMENT, WASTEWATERS, *AQUIFER,
0656 HYDROCARBONS , FATE, BIODEGRADATION, SOIL,
0658 HYDROCARBONS , FATE, CRUDE OIL, CHEMICAL ANALYSIS, WEATHERING, *PHOTODEGRADATION,

0667 HYDROCARBONS , FATE, WEATHERING, PHYSICAL EFFECTS, *POLLUTANT TRANSFER,
0672 HYDROCARBONS , FRESHWATER, DISPERSIONS, MODELS, SEDIMENTATION, *COAGULATION,
0696 HYDROCARBONS , CHEMICAL ANALYSIS, *BIOGENIC VS PETROLEUM,
0700 HYDROCARBONS , DETECTION, CHEMICAL ANALYSIS, *SULFUR DETERMINATION,
0703 HYDROCARBONS , FOOD WEB, BIOMASS, ALGAE, ZOOPLANKTON, *BIOGENIC ORIGIN,
R023 HYDROCARBONS , SAMPLING, WATER QUALITY, MONITORING, PAH, *QUALITY CONTROL SAMPLES,
R040 HYDROCARBONS , FUEL OIL, CHRONIC EFFECTS, BEHAVIOR, MARINE ORGANISMS, SUBLETHAL EFFECTS, *CHEMORECEPTION,
R044 HYDROCARBONS , BIOLOGICAL EFFECTS, TOXICITY, MARINE ORGANISMS, OCEANS, *BIO-INDICATORS,
R048 HYDROCARBONS , DETECTION, ALGAE, TOXICITY, *BIOASSAY, *CULTURES,
R050 HYDROCARBONS , GROWTH, FATE, ECOSYSTEMS, INTERTIDAL ZONE, MORTALITY, UPTAKE, MOLLUSKS,
0575 ICE, ECOSYSTEMS, CRUDE OIL, ARCTIC, MARINE ORGANISMS, TOXICITY, WEATHERING, SEDIMENTS,
0589 ICE, FATE, BEHAVIOR, MOVEMENT, SPREADING, OIL SPILLS, MASSACHUSSETTS, *BUZZARDS BAY,
0657 ICE, CRUDE OIL, BEHAVIOR, ARCTIC, *OIL-ICE INTERACTIONS,
0665 ICE, CRUDE OIL, BEHAVIOR, ARCTIC, *OIL-IN-ICE,
0708 ICE, BEAUFORT SEA, *TOPOGRAPHY, SPILL CONTAINMENT,
0591 ILLINOIS, ECONOMIC EFFECTS, REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES, *HEXANES,
0441 IMCO, DESIGN-ENGINEERING, BALLAST , TANKERS, REGULATIONS, *COMPUTER METHODS,
0592 IMCO, EQUIPMENT, REGULATIONS, POLLUTION CONTROL, USCG, OIL INDUSTRY,
0492 INCINERATION, FLOCCULATION, FILTRATION , EMULSIONS, OIL-WATER SEPARATION, *COMPRESSOR DRAINS,
0340 INDIAN OCEAN, DISTRIBUTION, ATLANTIC OCEAN, SAMPLING, TAR, OCEANS, NEUSTON, *NEUSTONIC PERIPHYTON,
0447 INDUSTRIES, BIODEGRADATION, WASTEWATER TREATMENT, WASTE OIL TREATMENT, OIL SPILLS, PETROCHEMICALS, MICROORGANISMS,
0449 INDUSTRIES, BIODEGRADATION, ADSORPTION, PETROCHEMICALS, WASTEWATER TREATMENT, OXIDATION, *ACTIVATED CARBON,
0455 INDUSTRIES, DISPOSAL , BIODEGRADATION, WASTE OIL TREATMENT, WASTEWATER TREATMENT, RECLAMATION,
0473 INDUSTRIES, REFINERIES, WASTEWATER TREATMENT,
0524 INDUSTRIES, ENVIRONMENTAL EFFECTS, COST ANALYSIS, POLLUTION CONTROL,
0525 INDUSTRIES, COST ANALYSIS, POLLUTION CONTROL,
0606 INDUSTRIES, HYDROCARBONS , FISH, FATE, CONTAMINANTS, BIOLOGICAL EFFECTS, PACIFIC OCEAN,
0685 INDUSTRIES, COST ANALYSIS, BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT, POLLUTION CONTROL,
0686 INDUSTRIES, COST ANALYSIS, BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT, POLLUTION CONTROL,
0687 INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, POLLUTION CONTROL, *OZONE,
0688 INDUSTRIES, EQUIPMENT, BIBLIOGRAPHIES, WASTEWATER TREATMENT, POLLUTION CONTROL, *OZONE,
0689 INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, POLLUTION CONTROL, *MEMBRANES,
0690 INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, POLLUTION CONTROL, *MEMBRANES,
0691 INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, POLLUTION CONTROL, *MEMBRANES,
0693 INDUSTRIES, ECONOMICS, COST ANALYSIS, BIBLIOGRAPHIES, POLLUTION CONTROL, WASTEWATER TREATMENT,
0702 INDUSTRIES, EQUIPMENT, POLLUTION CONTROL, WASTEWATERS,
0706 INDUSTRIES, ECOSYSTEMS, RESOURCE MANAGEMENT,
0707 INDUSTRIES, GOVERNMENT AGENCIES, POLLUTION CONTROL, REGULATIONS,
0316 INFORMATION SYSTEMS, GUIDELINES, ENVIRONMENTAL EFFECTS, STATISTICS, MODELS, NOAA,
0317 INFORMATION SYSTEMS, CANADA, OIL SPILLS, STATISTICS, *RATES,
0324 INFORMATION SYSTEMS, MONITORING, STATISTICS, *COMPUTER DIRECTORY,
0503 INFORMATION SYSTEMS, CONTINGENCY PLANNING, CANADA, PERSONNEL TRAINING, POLLUTION PREVENTION, OIL SPILLS, INLAND,
R038 INFORMATION SYSTEMS, PERSONNEL TRAINING, TANKERS, STATISTICS, *TANKER CASUALTIES, *COMPUTER SERVICES,
0503 INLAND, INFORMATION SYSTEMS, CONTINGENCY PLANNING, CANADA, PERSONNEL TRAINING, POLLUTION PREVENTION, OIL SPILLS,
0520 INLAND, EQUIPMENT, DISPERSANTS, SPILL CLEANUP, PETROLEUM PRODUCTS, *SORBENTS, PERSONNEL TRAINING, *FIRE-FIGHTING,
0604 INLAND, ENVIRONMENTAL EFFECTS, SOURCES, OIL INDUSTRY, TANKERS, NATURAL SEEPAGE, WATER QUALITY,
R039 INLAND, ENVIRONMENTAL PROTECTION, DETECTION, DESIGN-ENGINEERING, LEAKAGE, PIPELINES, OFFSHORE DEVELOPMENT,
0521 INTERNATIONAL AGREEMENTS, TANKERS, POLLUTION PREVENTION, SEGREGATED BALLAST, *CRUDE OIL WASHING,
0676 INTERNATIONAL AGREEMENTS, CONTAMINANTS, BOOK REVIEW, POLLUTION CONTROL, LEGISLATION,
0682 INTERNATIONAL AGREEMENTS, GREAT LAKES, CANADA, WATER QUALITY, US, POLLUTION CONTROL,
0684 INTERNATIONAL AGREEMENTS, COMPENSATION, ARGO MERCHANT SPILL, TANKERS, LIABILITY,
0680 INTERNATIONAL CONVENTIONS, EKOFISK BLOWOUT, COMPENSATION, LIABILITY,
0681 INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, TANKERS,
0683 INTERNATIONAL CONVENTIONS, POLLUTION CONTROL, *RATIFICATION,
0350 INTERTIDAL ZONE, DISTRIBUTION, BASELINE STUDIES, ALASKA, SAMPLING, MOLLUSKS, PORTS, *MACOMA BALTHICA,

0510 INTERTIDAL ZONE, CONTINGENCY PLANNING, COASTS, CANADA, OIL SPILLS, SPILL CLEANUP,
0572 INTERTIDAL ZONE, DISTRIBUTION, CHRONIC EFFECTS, BASELINE STUDIES, ALASKA, OIL TERMINALS, MOLLUSKS, *MACOMA BALTHICA,
R047 INTERTIDAL ZONE, CHRONIC EFFECTS, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF, NATURAL SEEPAGE,
R050 INTERTIDAL ZONE, HYDROCARBONS , GROWTH, FATE, ECOSYSTEMS, MORTALITY, UPTAKE, MOLLUSKS,
0347 INVERTEBRATES, HYDROCARBONS , GREENLAND, FISH, COASTS, SAMPLING, SEDIMENTS,
0353 INVERTEBRATES, HYDROCARBONS , FISH, CHROMATOGRAPHY, SAMPLING, PLANKTON , UK, *N-ALKANES,
0563 INVERTEBRATES, FISH, CHRONIC EFFECTS, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, METABOLISM,
0584 INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ALGAE, PETROLEUM PRODUCTS, MORTALITY, MICROORGANISMS,
0433 JAPAN, OIL TANKS, STORAGE, POLLUTION PREVENTION, *AIR CUSHION MOVEMENT ,
0463 JAPAN, BIODEGRADATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT, OIL INDUSTRY, PETROCHEMICALS,
0607 JAPAN, ECOSYSTEMS, OIL SPILLS, SHIPS, OIL DISCHARGES, WATER QUALITY, *TOKYO BAY,
0578 LAKES , HYDROCARBONS , BIOLOGICAL EFFECTS, FUELS, *OUTBOARD MOTOR EXHAUST,
R039 LEAKAGE, INLAND, ENVIRONMENTAL PROTECTION, DETECTION, DESIGN-ENGINEERING, PIPELINES, OFFSHORE DEVELOPMENT,
0596 LEGISLATION, CONTAMINATION, SOURCES, POLLUTION CONTROL,
0625 LEGISLATION, GEORGES BANK, FISHERIES, COMPENSATION, OIL-GAS LEASING, LIABILITY, OCS,
0631 LEGISLATION, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION CONTROL, *COASTAL ZONE MANAGEMENT, *CONFERENCE,
0674 LEGISLATION, TANKERS, DESIGN-ENGINEERING, SAFETY, US, REGULATIONS, SEGREGATED BALLAST,
0675 LEGISLATION, COMPENSATION, US, LIABILITY, OIL INDUSTRY, TANKERS, OIL TERMINALS, *OIL SPILL FUND,
0676 LEGISLATION, INTERNATIONAL AGREEMENTS, CONTAMINANTS, BOOK REVIEW, POLLUTION CONTROL,
0677 LEGISLATION, ENVIRONMENTAL PROTECTION, OFFSHORE DEVELOPMENT, *TREATY, *LAW OF SEA CONFERENCE,
0625 LIABILITY, LEGISLATION, GEORGES BANK, FISHERIES, COMPENSATION, OIL-GAS LEASING, OCS,
0675 LIABILITY, LEGISLATION, COMPENSATION, US, OIL INDUSTRY, TANKERS, OIL TERMINALS, *OIL SPILL FUND,
0680 LIABILITY, INTERNATIONAL CONVENTIONS, EKOFISK BLOWOUT, COMPENSATION,
0684 LIABILITY, INTERNATIONAL AGREEMENTS, COMPENSATION, ARGO MERCHANT SPILL, TANKERS,
0436 LOUISIANA, DISPOSAL , STORAGE, MEXICO/GULF OF, *SALT DOMES, *BRINE DISCHARGE,
0453 LUBRICATING OIL, FUEL OIL, BILGES, ULTRAFILTRATION, WASTEWATER TREATMENT,
0480 LUBRICATING OIL, FUELS , FILTRATION , BILGES, OIL-WATER SEPARATION, SHIPS,
0498 LUBRICATING OIL, WASTE OIL, RECLAMATION, SLUDGE , PATENT,
0499 LUBRICATING OIL, WASTE OIL, RECLAMATION, PATENT,
0574 MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL, BASELINE STUDIES, METULA SPILL, MARINE ORGANISMS, MORTALITY,
0603 MAGELLAN/STRAIT OF, COASTS, SEDIMENTS, METULA SPILL, SEDIMENTATION, *GEOMORPHOLOGY,
R049 MAGELLAN/STRAIT OF, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS, METULA SPILL, SEDIMENTS,
0539 MAINE, BIOLOGICAL EFFECTS, MOLLUSKS, MORTALITY, OIL SPILLS, *CLAMS,
0429 MANUALS, BIRDS, RESTORATION, OIL SPILLS, *CARE & TREATMENT,
0430 MANUALS, GUIDELINES, BIRDS, RESTORATION, WILDLIFE, *OILED ANIMALS , *CARE & TREATMENT,
0516 MANUALS, SPILL CLEANUP, WILDLIFE, MORTALITY,
0623 MANUALS, ENVIRONMENTAL PROTECTION, EIS, OIL SPILLS, POLLUTION CONTROL, TANKERS, PLATFORMS, REFINERIES, PETROCHEMICALS,
R021 MANUALS, EPA, ANALYTICAL TECHNIQUES, MONITORING, SOURCE IDENTIFICATION, OIL SPILLS,
R031 MANUALS, EQUIPMENT, SPILL CLEANUP, SHORELINES, ENVIRONMENTAL PROTECTION, RESTORATION, *FIELD METHODS,
0352 MARINE ORGANISMS, HYDROCARBONS , FATE, BENTHOS, SAMPLING, SEDIMENTS, UPTAKE,
0357 MARINE ORGANISMS, HYDROCARBONS , CHEMICAL ANALYSIS,
0359 MARINE ORGANISMS, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, *BIOGENIC HYDROCARBONS,
0408 MARINE ORGANISMS, SPILL CLEANUP, PETROLEUM PRODUCTS, PATENT,
0532 MARINE ORGANISMS, GROWTH, FUEL OIL, CRUDE OIL, METABOLISM, REPRODUCTION,
0533 MARINE ORGANISMS, CHEMICAL ANALYSIS, HYDROCARBONS , TOXICITY, UPTAKE, RELEASE, WSF,
0543 MARINE ORGANISMS, EMULSIFIERS, CRUSTACEANS, SUBLETHAL EFFECTS, MORTALITY, *COPEPODS,
0544 MARINE ORGANISMS, AROMATIC HYDROCARBONS, UPTAKE, ZOOPLANKTON, *COPEPODS, *RADIOLABELED NAPHTHALENES,
0546 MARINE ORGANISMS, HYDROCARBONS , FISH, CRUSTACEANS, TOXICITY, METABOLISM, MOLLUSKS, *XENOBIOTIC CHEMICALS,
0553 MARINE ORGANISMS, TOXICITY, METABOLISM, SUBLETHAL EFFECTS, *EGG AND LARVAL STAGES,
0560 MARINE ORGANISMS, ECHINODERMS, DISPERSANTS, BIOLOGICAL EFFECTS, *SEA URCHIN EGGS, *FERTILIZATION, *BIO-INDICATORS,
0562 MARINE ORGANISMS, BOOK REVIEW, BIOLOGICAL EFFECTS,
0574 MARINE ORGANISMS, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL, BASELINE STUDIES, METULA SPILL, MORTALITY,
0575 MARINE ORGANISMS, ICE, ECOSYSTEMS, CRUDE OIL, ARCTIC, TOXICITY, WEATHERING, SEDIMENTS,
0590 MARINE ORGANISMS, ECONOMIC EFFECTS, COMPENSATION, CALIFORNIA, OIL SPILLS, *MONETARY VALUES,

0593 MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, SUBLETHAL EFFECTS, SOURCES, *SYMPOSIUM,
0595 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, COASTS, SHORELINES, UK, TOXICITY,
0608 MARINE ORGANISMS, HYDROCARBONS , FATE, ARCTIC, PETROLEUM PRODUCTS, OCEANS, SUBARCTIC REGIONS, SOURCES,
0610 MARINE ORGANISMS, HYDROCARBONS , CHRONIC EFFECTS, TOXICITY, *TOXICOLOGICAL RESEARCH,
0617 MARINE ORGANISMS, FISH, CHRONIC EFFECTS, ARGO MERCHANT SPILL, NOAA, SEDIMENTS,
0618 MARINE ORGANISMS, BIOLOGICAL EFFECTS, OFFSHORE DRILLING, TOXICITY, *DRILLING MUDS,
R025 MARINE ORGANISMS, CHRONIC EFFECTS, CHEMICAL ANALYSIS, ACUTE EFFECTS, OIL DISCHARGES, SAMPLING, SEAWATER, SEDIMENTS, TOXICITY,
R040 MARINE ORGANISMS, HYDROCARBONS , FUEL OIL, CHRONIC EFFECTS, BEHAVIOR, SUBLETHAL EFFECTS, *CHEMORECEPTION,
R044 MARINE ORGANISMS, HYDROCARBONS , BIOLOGICAL EFFECTS, TOXICITY, OCEANS, *BIO-INDICATORS,
R045 MARINE ORGANISMS, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, MORTALITY, SUBLETHAL EFFECTS,
R051 MARINE ORGANISMS, EXTRACTION, BIOLOGICAL EFFECTS, PETROCHEMICALS, TOXICITY, OFFSHORE DRILLING, OIL TRANSPORT, *DRILLING MUDS,
0529 MARSHES, FUEL OIL, CRUSTACEANS, CHRONIC EFFECTS, OIL SPILLS, TOXICITY, MASSACHUSETTS, *UCA PAGNAX,
R043 MARSHES, ECOSYSTEMS, CRUDE OIL, CONTAMINATION, BASELINE STUDIES, ALASKA,
0620 MARYLAND, EPA, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION, NEW JERSEY,
0529 MASSACHUSETTS, MARSHES, FUEL OIL, CRUSTACEANS, CHRONIC EFFECTS, OIL SPILLS, TOXICITY, *UCA PAGNAX,
0522 MEDITERRANEAN SEA, HYDROCARBONS , CHRONIC EFFECTS, TAR, TANKERS, SOURCES, POLLUTION CONTROL,
0528 MEDITERRANEAN SEA, ENVIRONMENTAL PROTECTION, POLLUTION PREVENTION, UN,
0532 METABOLISM, MARINE ORGANISMS, GROWTH, FUEL OIL, CRUDE OIL, REPRODUCTION,
0540 METABOLISM, GROWTH, FISH, CRUDE OIL, *BENZENE, *CLUPEA HARENGUS PALLASI, *EMBRYOS, *LARVAE,
0541 METABOLISM, ECOSYSTEMS, DISTRIBUTION, BENTHOS, ARCTIC, *ABUNDANCE, USSR,
0545 METABOLISM, FUEL OIL, CRUDE OIL, CANADA, BACTERIA, TOXICITY, UPTAKE,
0546 METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FISH, CRUSTACEANS, TOXICITY, MOLLUSKS, *XENOBIOTIC CHEMICALS,
0553 METABOLISM, MARINE ORGANISMS, TOXICITY, SUBLETHAL EFFECTS, *EGG AND LARVAL STAGES,
0563 METABOLISM, INVERTEBRATES, FISH, CHRONIC EFFECTS, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY,
0582 METABOLISM, HYDROCARBONS , FOOD WEB, FISH, BIOLOGICAL EFFECTS, UPTAKE, *HEXADECANE, *BENZO(A)PYRENE,
0587 METABOLISM, FISHERIES, CONTAMINATION, CHROMATOGRAPHY, MOLLUSKS, RELEASE, *MUSSEL CULTURES,
0699 METABOLISM, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BACTERIA, MICROORGANISMS, *BACTERIUM ALBUM, *PHENOL,
R041 METABOLISM, CORALS, BIOLOGICAL EFFECTS, BEHAVIOR, OIL SHALE, *DRILLING FLUIDS, MEXICO/GULF OF,
R054 METABOLISM, DECOMPOSITION, CRUDE OIL, BIODEGRADATION, BASELINE STUDIES, ARCTIC, MICROORGANISMS, SUBARCTIC REGIONS,
0574 METULA SPILL, MARINE ORGANISMS, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL, BASELINE STUDIES, MORTALITY,
0603 METULA SPILL, MAGELLAN/STRAIT OF, COASTS, SEDIMENTS, SEDIMENTATION, *GEOMORPHOLOGY,
R049 METULA SPILL, MAGELLAN/STRAIT OF, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS, SEDIMENTS,
0377 MEXICO/GULF OF, HYDROCARBONS , SOURCE IDENTIFICATION, PRODUCTION , MISSISSIPPI RIVER,
0436 MEXICO/GULF OF, LOUISIANA, DISPOSAL , STORAGE, *SALT DOMES, *BRINE DISCHARGE,
R041 MEXICO/GULF OF, METABOLISM, CORALS, BIOLOGICAL EFFECTS, BEHAVIOR, OIL SHALE, *DRILLING FLUIDS,
0465 MICHIGAN, GREAT LAKES, DISPOSAL , DISPERSIONS, COASTS, WASTEWATERS, REFINERIES, SPREADING,
0447 MICROORGANISMS, INDUSTRIES, BIODEGRADATION, WASTEWATER TREATMENT, WASTE OIL TREATMENT, OIL SPILLS, PETROCHEMICALS,
0468 MICROORGANISMS, WASTEWATER TREATMENT, REFINERIES, *TEMPERATURE EFFECTS,
0534 MICROORGANISMS, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, SURFACTANTS,
0538 MICROORGANISMS, HEALTH HAZARDS, POLLUTION CONTROL, *MICROBIOLOGICAL ASPECTS,
0542 MICROORGANISMS, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, BIODEGRADATION, TANKERS,
0584 MICROORGANISMS, INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ALGAE, PETROLEUM PRODUCTS, MORTALITY,
0641 MICROORGANISMS, HYDROCARBONS , CRUDE OIL, BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, SEDIMENTS, SEAWATER,
0642 MICROORGANISMS, CRUDE OIL, CHEMICAL ANALYSIS, BIODEGRADATION, ANALYTICAL TECHNIQUES, *COMPARISONS,
0646 MICROORGANISMS, FUELS , CRUDE OIL, BIODEGRADATION, SEAWATER, POLLUTION CONTROL,
0647 MICROORGANISMS, CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, SEDIMENTS,
0659 MICROORGANISMS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIODEGRADATION, ARCTIC, PHYSICAL EFFECTS,

0699 MICROORGANISMS, METABOLISM, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, BACTERIA, *BACTERIUM ALBUM, *PHENOL,
R042 MICROORGANISMS, FRESHWATER, ECOSYSTEMS, BIOLOGICAL EFFECTS, BIODEGRADATION, OIL SLICKS, *STABILITY,
R053 MICROORGANISMS, DISTRIBUTION, BIODEGRADATION, OCEANS,
R054 MICROORGANISMS, METABOLISM, DECOMPOSITION, CRUDE OIL, BIODEGRADATION, BASELINE STUDIES, ARCTIC, SUBARCTIC REGIONS,
0377 MISSISSIPPI RIVER, MEXICO/GULF OF, HYDROCARBONS , SOURCE IDENTIFICATION, PRODUCTION ,
0316 MODELS, INFORMATION SYSTEMS, GUIDELINES, ENVIRONMENTAL EFFECTS, STATISTICS, NOAA,
0384 MODELS, SPILL CONTAINMENT, *HYDRODYNAMICS,
0576 MODELS, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS, PLANKTON ,
0648 MODELS, HYDROCARBONS , EVAPORATION, TAR, SEA SURFACE, WEATHERING,
0669 MODELS, FATE, SPILL CLEANUP, OIL SLICKS, *THEORETICAL PREDICTIONS,
0670 MODELS, ESTUARIES, POLLUTION CONTROL, SOURCE IDENTIFICATION, SAMPLING,
0672 MODELS, HYDROCARBONS , FRESHWATER, DISPERSIONS, SEDIMENTATION, *COAGULATION,
0673 MODELS, GROUNDWATER, CONTAMINATION, PETROLEUM PRODUCTS, *HYDRODYNAMICS,
0709 MODELS, COASTS, STATISTICAL ANALYSIS, POLLUTION PREVENTION, RESOURCE MANAGEMENT, PHYSICAL EFFECTS, *POLLUTION SUSCEPTIBILITY,
R057 MODELS, FATE, OIL SHALE, WASTEWATERS, SOIL, SOURCES, *POLLUTANT TRANSPORT,
0350 MOLLUSKS, INTERTIDAL ZONE, DISTRIBUTION, BASELINE STUDIES, ALASKA, SAMPLING, PORTS, *MACOMA BALTHICA,
0361 MOLLUSKS, FUEL OIL, DETECTION, AROMATIC HYDROCARBONS, UK, *MYTILUS EDULIS,
0531 MOLLUSKS, PETROLEUM PRODUCTS, UPTAKE, *OXYGEN DEMAND,
0535 MOLLUSKS, FUEL OIL, CRUDE OIL, TOXICITY, WSF, WASTE OIL, MORTALITY, *MERCENARIA,
0536 MOLLUSKS, HYDROCARBONS , FUELS , FUEL OIL, BIOLOGICAL EFFECTS, *MYTILUS EDULIS, *FOOD INTAKE,
0539 MOLLUSKS, MAINE, BIOLOGICAL EFFECTS, MORTALITY, OIL SPILLS, *CLAMS,
0546 MOLLUSKS, METABOLISM, MARINE ORGANISMS, HYDROCARBONS , FISH, CRUSTACEANS, TOXICITY, *XENOBIOTIC CHEMICALS,
0558 MOLLUSKS, HYDROCARBONS , GROWTH, WSF, TOXICITY, *MUSSEL LARVAE,
0559 MOLLUSKS, CRUDE OIL, BEHAVIOR, BALTIC SEA, SUBLETHAL EFFECTS,
0567 MOLLUSKS, HYDROCARBONS , BLACK SEA, UPTAKE, *MYTILUS GALLOPROVINCIALIS, *PARAFFINS,
0570 MOLLUSKS, HYDROCARBONS , CHROMATOGRAPHY, SAMPLING, SEDIMENTS, *PECTEN YESSOENSIS,
0572 MOLLUSKS, INTERTIDAL ZONE, DISTRIBUTION, CHRONIC EFFECTS, BASELINE STUDIES, ALASKA, OIL TERMINALS, *MACOMA BALTHICA,
0573 MOLLUSKS, CRUDE OIL, CHROMATOGRAPHY, SPECTROSCOPY, UPTAKE, *OYSTERS, *SULFUR COMPOUNDS,
0587 MOLLUSKS, METABOLISM, FISHERIES, CONTAMINATION, CHROMATOGRAPHY, RELEASE, *MUSSEL CULTURES,
0588 MOLLUSKS, FUEL OIL, FRANCE, CONTAMINATION, OIL SPILLS, UPTAKE, RELEASE, *PORT DE BOUC SPILL, *MUSSELS,
R050 MOLLUSKS, INTERTIDAL ZONE, HYDROCARBONS , GROWTH, FATE, ECOSYSTEMS, MORTALITY, UPTAKE,
0322 MONITORING, DETECTION, DESIGN-ENGINEERING, BILGES, BALLAST , SHIPS, PRODUCT INFORMATION, *OIL CONTENT ANALYSER,
0323 MONITORING, EQUIPMENT, BALLAST , PRODUCT INFORMATION, POLLUTION CONTROL, *BABCOCK CONTROLS,
0324 MONITORING, INFORMATION SYSTEMS, STATISTICS, *COMPUTER DIRECTORY,
0325 MONITORING, HYDROCARBONS , FINLAND, COASTS, SEAWATER, SAMPLING,
0326 MONITORING, DISPERSANTS, DETECTION, CHEMICAL ANALYSIS, POLLUTION CONTROL, TOXICITY, *BIOASSAY,
0327 MONITORING, DETECTION, SAMPLING, PETROLEUM PRODUCTS, WASTEWATERS, PATENT,
0328 MONITORING, DETECTION, PETROLEUM PRODUCTS, POLLUTION PREVENTION, PATENT,
0329 MONITORING, EMULSIONS, DETECTION, *OIL IN WATER, PATENT, *PHOTOSENSOR,
0330 MONITORING, CONTAMINATION, NORTH SEA, *INTERNATIONAL PROGRAM,
0331 MONITORING, GROUNDWATER, ENVIRONMENTAL EFFECTS, DEVELOPMENT , OIL SHALE, WATER QUALITY, *SURFACE MINING,
0332 MONITORING, DETECTION, OIL SLICKS, *PASSIVE MICROWAVE IMAGER,
0333 MONITORING, BILGES, SHIPS, DESIGN-ENGINEERING, DETECTION, *CARBON ANALYSIS,
0334 MONITORING, FUEL OIL, DETECTION, SLUDGE, PATENT, *UV FLUORESCENCE,
0335 MONITORING, EQUIPMENT, DETECTION, PRODUCT INFORMATION, *INFRARED DETECTORS,
0336 MONITORING, EPA, REMOTE SENSING, OIL SPILLS, *LANDSAT, *ENVIRO-POD,
0337 MONITORING, BLOWOUTS, REMOTE SENSING, OIL SLICKS, *NASA HEAT CAPACITY MAPPING MISSION,
0338 MONITORING, ESTUARIES, DISPERSIONS, DETECTION, REMOTE SENSING,
0365 MONITORING, HYDROCARBONS , CHROMATOGRAPHY, BIODEGRADATION,
0454 MONITORING, ANALYTICAL TECHNIQUES, SHIPS, POLLUTION CONTROL, *ENZYME TECHNOLOGY,
0512 MONITORING, EQUIPMENT, DESIGN-ENGINEERING, OIL TANKS, POLLUTION PREVENTION, PRODUCT INFORMATION, *OPTIC LIQUID LEVEL SENSOR,
0514 MONITORING, PORTS, TANKERS, POLLUTION CONTROL, SAFETY, PERSONNEL TRAINING, *EXXON,
0597 MONITORING, ENVIRONMENTAL EFFECTS, DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCES, PETROLEUM PRODUCTS,
0615 MONITORING, HYDROCARBONS , ENVIRONMENTAL EFFECTS, OCEANS, POLLUTION CONTROL, UN,
0697 MONITORING, WATER QUALITY, *BIO-INDICATORS,
R021 MONITORING, MANUALS, EPA, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS,
R022 MONITORING, DETECTION, OIL SPILLS, US, *ALARM SYSTEM,
R023 MONITORING, HYDROCARBONS , SAMPLING, WATER QUALITY, PAH, *QUALITY CONTROL SAMPLES,
R033 MONITORING, FISH, BIOLOGICAL EFFECTS, ALASKA, PIPELINES, WATER QUALITY, STREAMS, *TAPS,

0313 MORTALITY, FUEL OIL, FISH, OIL SPILLS, SPILL CLEANUP, *ADRIAN MAERSK, *HONG KONG,
0516 MORTALITY, MANUALS, SPILL CLEANUP, WILDLIFE,
0535 MORTALITY, MOLLUSKS, FUEL OIL, CRUDE OIL, TOXICITY, WSF, WASTE OIL, *MERCENARIA,
0537 MORTALITY, DISPERSANTS, BIRDS, BEHAVIOR, ACUTE EFFECTS, *SEABIRDS , OIL SLICKS,
0539 MORTALITY, MOLLUSKS, MAINE, BIOLOGICAL EFFECTS, OIL SPILLS, *CLAMS,
0543 MORTALITY, MARINE ORGANISMS, EMULSIFIERS, CRUSTACEANS, SUBLETHAL EFFECTS, *COPEPODS,
0556 MORTALITY, FUEL OIL, ACUTE EFFECTS, TOXICITY, WSF, ZOOPLANKTON,
0557 MORTALITY, FUEL OIL, CRUSTACEANS, CRUDE OIL, TOXICITY, WSF, *AMPHIPODS,
0574 MORTALITY, METULA SPILL, MARINE ORGANISMS, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL, BASELINE STUDIES,
0581 MORTALITY, FISH, BIOLOGICAL EFFECTS, *MINNOWS, *GOLDFISH, *NORADRENALINE LEVELS, *BRAIN TISSUES,
0584 MORTALITY, MICROORGANISMS, INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ALGAE, PETROLEUM PRODUCTS,
0585 MORTALITY, COASTS, BIRDS, BIOLOGICAL EFFECTS, BALTIC SEA, POLAND, *CLANGULA HYEMALIS,
0599 MORTALITY, CARCINOGENS, BIODEGRADATION, PETROLEUM PRODUCTS, SUBLETHAL EFFECTS, UPTAKE, RELEASE,
R045 MORTALITY, MARINE ORGANISMS, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, PETROLEUM PRODUCTS, TOXICITY, SUBLETHAL EFFECTS,
R050 MORTALITY, MOLLUSKS, INTERTIDAL ZONE, HYDROCARBONS , GROWTH, FATE, ECOSYSTEMS, UPTAKE,
0589 MOVEMENT, ICE, FATE, BEHAVIOR, SPREADING, OIL SPILLS, MASSACHUSSETTS, *BUZZARDS BAY,
0650 MOVEMENT, HYDROCARBONS , GROUNDWATER, FRESHWATER, PHYSICAL EFFECTS, WASTEWATERS, *AQUIFER,
0320 NATURAL SEEPAGE, CANADA, OIL SLICKS, SAMPLING, *BAFFIN ISLAND,
0346 NATURAL SEEPAGE, HYDROCARBONS , DETECTION, COASTS, SAMPLING, *TAIWAN,
0604 NATURAL SEEPAGE, INLAND, ENVIRONMENTAL EFFECTS, SOURCES, OIL INDUSTRY, TANKERS, WATER QUALITY,
R047 NATURAL SEEPAGE, INTERTIDAL ZONE, CHRONIC EFFECTS, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF,
0340 NEUSTON, INDIAN OCEAN, DISTRIBUTION, ATLANTIC OCEAN, SAMPLING, TAR, OCEANS, *NEUSTONIC PERIPHYTON,
0620 NEW JERSEY, MARYLAND, EPA, ENVIRONMENTAL EFFECTS, OFFSHORE EXPLORATION,
0316 NOAA, MODELS, INFORMATION SYSTEMS, GUIDELINES, ENVIRONMENTAL EFFECTS, STATISTICS,
0507 NOAA, EQUIPMENT, EPA, COMPENSATION, ALASKA, PERSONNEL TRAINING, SPILL CLEANUP,
0617 NOAA, MARINE ORGANISMS, FISH, CHRONIC EFFECTS, ARGO MERCHANT SPILL, SEDIMENTS,
0321 NORTH SEA, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, CRUDE OIL, SPILL CLEANUP, NORWAY,
0330 NORTH SEA, MONITORING, CONTAMINATION, *INTERNATIONAL PROGRAM,
0395 NORTH SEA, EQUIPMENT, EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, PRODUCT INFORMATION,
0399 NORTH SEA, EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, PRODUCT INFORMATION, *FRAMO SKIMMER,
0594 NORTH SEA, CONTINGENCY PLANNING, BLOWOUTS, POLLUTION PREVENTION, REGULATIONS, SAFETY, UK,
0605 NORTH SEA, FISHERIES, ECONOMIC EFFECTS, COST ANALYSIS, OIL SPILLS, OFFSHORE DEVELOPMENT,
0619 NORTH SEA, OIL FIELDS, OIL INDUSTRY, *DEBRIS AND EQUIPMENT CLEANUP,
0624 NORTH SEA, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, OIL INDUSTRY, UK, *SHETLAND ISLANDS,
0628 NORTH SEA, OFFSHORE DEVELOPMENT, OIL SPILLS, SANTA BARBARA CHANNEL, *CELTIC SEA, *GEOLOGIC CONDITIONS,
0630 NORTH SEA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, UK,
0637 NORTH SEA, BIOLOGICAL EFFECTS, OFFSHORE DRILLING, TANKERS, PORTS, OIL TERMINALS, SOURCES, UK, *CELTIC SEA,
0321 NORWAY, NORTH SEA, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, CRUDE OIL, SPILL CLEANUP,
0602 NORWAY, CONTAMINATION, PETROLEUM PRODUCTS, SEDIMENTS,
0340 OCEANS, NEUSTON, INDIAN OCEAN, DISTRIBUTION, ATLANTIC OCEAN, SAMPLING, TAR, *NEUSTONIC PERIPHYTON,
0342 OCEANS, EQUIPMENT, CHEMICAL ANALYSIS, SAMPLING, TAR, *PLASTICS, *LITTER,
0349 OCEANS, HYDROCARBONS , BASELINE STUDIES, SAMPLING, SEA SURFACE, *COASTAL WATERS, *SHIPPING LANES,
0564 OCEANS, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, *PROCEEDINGS ICES WORKSHOP,
0600 OCEANS, HYDROCARBONS , PETROLEUM PRODUCTS, OIL TRANSPORT, SEA SURFACE, *AIR-SEA INTERFACE,
0608 OCEANS, MARINE ORGANISMS, HYDROCARBONS , FATE, ARCTIC, PETROLEUM PRODUCTS, SUBARCTIC REGIONS, SOURCES,
0615 OCEANS, MONITORING, HYDROCARBONS , ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, UN,
R030 OCEANS, FRESHWATER, SPILL RECOVERY, POLLUTION PREVENTION, *AMINE CARBAMATE GELATION TECHNIQUES,
R044 OCEANS, MARINE ORGANISMS, HYDROCARBONS , BIOLOGICAL EFFECTS, TOXICITY, *BIO-INDICATORS,
R053 OCEANS, MICROORGANISMS, DISTRIBUTION, BIODEGRADATION,
0622 OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT,
0625 OCS, LIABILITY, LEGISLATION, GEORGES BANK, FISHERIES, COMPENSATION, OIL-GAS LEASING,
0627 OCS, GOVERNMENT AGENCIES, ENVIRONMENTAL EFFECTS, CANADA, REGULATIONS, OFFSHORE DRILLING, *LABRADOR SEA,
0632 OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT,

0634 OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN, OFFSHORE DRILLING, TANKERS,
0635 OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OFFSHORE DRILLING, SAFETY,
0636 OCS, DESIGN-ENGINEERING, ATLANTIC OCEAN, OFFSHORE DRILLING, POLLUTION PREVENTION, RESOURCE MANAGEMENT, *WORKSHOP,
0679 OCS, GUIDELINES, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING,
0605 OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES, ECONOMIC EFFECTS, COST ANALYSIS, OIL SPILLS,
0622 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN,
0624 OFFSHORE DEVELOPMENT, NORTH SEA, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, OIL INDUSTRY, UK, *SHETLAND ISLANDS,
0628 OFFSHORE DEVELOPMENT, NORTH SEA, OIL SPILLS, SANTA BARBARA CHANNEL, *CELTIC SEA, *GEOLOGIC CONDITIONS,
0630 OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS, UK,
0632 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN,
0677 OFFSHORE DEVELOPMENT, LEGISLATION, ENVIRONMENTAL PROTECTION, *TREATY, *LAW OF SEA CONFERENCE,
0679 OFFSHORE DEVELOPMENT, OCS, GUIDELINES, BASELINE STUDIES, OIL-GAS LEASING,
R032 OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING, PIPELINES, POLLUTION PREVENTION,
R039 OFFSHORE DEVELOPMENT, LEAKAGE, INLAND, ENVIRONMENTAL PROTECTION, DETECTION, DESIGN-ENGINEERING, PIPELINES,
0618 OFFSHORE DRILLING, MARINE ORGANISMS, BIOLOGICAL EFFECTS, TOXICITY, *DRILLING MUDS,
0627 OFFSHORE DRILLING, OCS, GOVERNMENT AGENCIES, ENVIRONMENTAL EFFECTS, CANADA, REGULATIONS, *LABRADOR SEA,
0634 OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN, TANKERS,
0635 OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, SAFETY,
0636 OFFSHORE DRILLING, OCS, DESIGN-ENGINEERING, ATLANTIC OCEAN, POLLUTION PREVENTION, RESOURCE MANAGEMENT, *WORKSHOP,
0637 OFFSHORE DRILLING, NORTH SEA, BIOLOGICAL EFFECTS, TANKERS, PORTS, OIL TERMINALS, SOURCES, UK, *CELTIC SEA,
R051 OFFSHORE DRILLING, MARINE ORGANISMS, EXTRACTION, BIOLOGICAL EFFECTS, PETROCHEMICALS, TOXICITY, OIL TRANSPORT, *DRILLING MUDS,
R052 OFFSHORE DRILLING, FUEL OIL, EXTRACTION, ENVIRONMENTAL EFFECTS, OIL SHALE,
0620 OFFSHORE EXPLORATION, NEW JERSEY, MARYLAND, EPA, ENVIRONMENTAL EFFECTS,
0593 OFFSHORE PRODUCTION, MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, SUBLETHAL EFFECTS, SOURCES, *SYMPOSIUM,
0470 OIL DISCHARGES, BALLAST , TANKERS, POLLUTION PREVENTION, SLUDGE , *CRUDE OIL WASHING,
0508 OIL DISCHARGES, PERSONNEL TRAINING, TANKERS, OIL TRANSFER, POLLUTION PREVENTION, SAFETY, REGULATIONS,
0591 OIL DISCHARGES, ILLINOIS, ECONOMIC EFFECTS, REGULATIONS, POLLUTION CONTROL, *HEXANES,
0607 OIL DISCHARGES, JAPAN, ECOSYSTEMS, OIL SPILLS, SHIPS, WATER QUALITY, *TOKYO BAY,
R025 OIL DISCHARGES, MARINE ORGANISMS, CHRONIC EFFECTS, CHEMICAL ANALYSIS, ACUTE EFFECTS, SAMPLING, SEAWATER, SEDIMENTS, TOXICITY,
0351 OIL FIELDS, HYDROCARBONS , SAMPLING, WASTEWATERS, *ORGANIC COMPOUNDS,
0619 OIL FIELDS, NORTH SEA, OIL INDUSTRY, *DEBRIS AND EQUIPMENT CLEANUP,
0625 OIL-GAS LEASING, OCS, LIABILITY, LEGISLATION, GEORGES BANK, FISHERIES, COMPENSATION,
0679 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, GUIDELINES, BASELINE STUDIES,
0411 OIL INDUSTRY, GOVERNMENT AGENCIES, DISPERSANTS, CONTINGENCY PLANNING, AUSTRALIA, SPILL CLEANUP,
0463 OIL INDUSTRY, JAPAN, BIODEGRADATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT, PETROCHEMICALS,
0466 OIL INDUSTRY, EQUIPMENT, ADSORPTION, WASTEWATER TREATMENT, *ACTIVATED CARBON,
0476 OIL INDUSTRY, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PETROCHEMICALS, *REVIEW,
0592 OIL INDUSTRY, IMCO, EQUIPMENT, REGULATIONS, POLLUTION CONTROL, USCG,
0604 OIL INDUSTRY, NATURAL SEEPAGE, INLAND, ENVIRONMENTAL EFFECTS, SOURCES, TANKERS, WATER QUALITY,
0619 OIL INDUSTRY, OIL FIELDS, NORTH SEA, *DEBRIS AND EQUIPMENT CLEANUP,
0624 OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, UK, *SHETLAND ISLANDS,
0675 OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, US, TANKERS, OIL TERMINALS, *OIL SPILL FUND,
0331 OIL SHALE, MONITORING, GROUNDWATER, ENVIRONMENTAL EFFECTS, DEVELOPMENT , WATER QUALITY, *SURFACE MINING,
0472 OIL SHALE, ENVIRONMENTAL EFFECTS, DISPOSAL , SOLID WASTES, TAR SANDS, POLLUTION CONTROL, *SYNFUELS,
0519 OIL SHALE, EXTRACTION, EPA, DEVELOPMENT , POLLUTION CONTROL, WATER QUALITY, SOLID WASTES, *RESEARCH PROGRAMS,
0626 OIL SHALE, HEALTH HAZARDS, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , CONTAMINATION, SOCIO-ECONOMIC EFFECTS, RESTORATION,
R041 OIL SHALE, MEXICO/GULF OF, METABOLISM, CORALS, BIOLOGICAL EFFECTS, BEHAVIOR, *DRILLING FLUIDS,
R046 OIL SHALE, FISH, DETECTION, CARCINOGENS, PETROLEUM PRODUCTS, *BIOASSAY,
R052 OIL SHALE, OFFSHORE DRILLING, FUEL OIL, EXTRACTION, ENVIRONMENTAL EFFECTS,

R057 OIL SHALE, MODELS, FATE, WASTEWATERS, SOIL, SOURCES, *POLLUTANT TRANSPORT,
0320 OIL SLICKS, NATURAL SEEPAGE, CANADA, SAMPLING, *BAFFIN ISLAND,
0332 OIL SLICKS, MONITORING, DETECTION, *PASSIVE MICROWAVE IMAGER,
0337 OIL SLICKS, MONITORING, BLOWOUTS, REMOTE SENSING, *NASA HEAT CAPACITY MAPPING MISSION,
0374 OIL SLICKS, SOURCE IDENTIFICATION, WEATHERING, SPECTROSCOPY,
0406 OIL SLICKS, SPILL CLEANUP, SPILL RECOVERY, OIL-WATER SEPARATION, PATENT,
0537 OIL SLICKS, MORTALITY, DISPERSANTS, BIRDS, BEHAVIOR, ACUTE EFFECTS, *SEABIRDS ,
0609 OIL SLICKS, FATE, BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES, OIL SPILLS, POLLUTION CONTROL, RED SEA,
0639 OIL SLICKS, CHEMICAL EFFECTS, PHYSICAL EFFECTS, SEA SURFACE, *SURFACE FILMS, *GAS EXCHANGE,
0655 OIL SLICKS, FATE, DISPERSIONS, DISPERSANTS, UK,
0669 OIL SLICKS, MODELS, FATE, SPILL CLEANUP, *THEORETICAL PREDICTIONS,
R042 OIL SLICKS, MICROORGANISMS, FRESHWATER, ECOSYSTEMS, BIOLOGICAL EFFECTS, BIODEGRADATION, *STABILITY,
R056 OIL SLICKS, DISPERSIONS, PHYSICAL EFFECTS, *LITERATURE SURVEY,
0313 OIL SPILLS, MORTALITY, FUEL OIL, FISH, SPILL CLEANUP, *ADRIAN MAERSK, *HONG KONG,
0317 OIL SPILLS, INFORMATION SYSTEMS, CANADA, STATISTICS, *NATES,
0318 OIL SPILLS, ENVIRONMENTAL EFFECTS, STATISTICS, SPILL CLEANUP, *COMPUTER DIRECTORY,
0336 OIL SPILLS, MONITORING, EPA, REMOTE SENSING, *LANDSAT, *ENVIRO-POD,
0339 OIL SPILLS, DETECTION, ANALYTICAL TECHNIQUES, REMOTE SENSING, *BACKSCATTERING TECHNIQUES,
0379 OIL SPILLS, SOURCE IDENTIFICATION, *SPLITLESS INJECTION,
0382 OIL SPILLS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, USCG, SPECTROSCOPY,
0429 OIL SPILLS, MANUALS, BIRDS, RESTORATION, *CARE & TREATMENT,
0431 OIL SPILLS, ECOSYSTEMS, BOOK REVIEW, RESTORATION, *ECOLOGICAL DISASTERS,
0440 OIL SPILLS, FUELS , FUEL OIL, PETROLEUM PRODUCTS, STORAGE, OIL TRANSPORT, REFINING,
0447 OIL SPILLS, MICROORGANISMS, INDUSTRIES, BIODEGRADATION, WASTEWATER TREATMENT, WASTE OIL TREATMENT, PETROCHEMICALS,
0503 OIL SPILLS, INLAND, INFORMATION SYSTEMS, CONTINGENCY PLANNING, CANADA, PERSONNEL TRAINING, POLLUTION PREVENTION,
0510 OIL SPILLS, INTERTIDAL ZONE, CONTINGENCY PLANNING, COASTS, CANADA, SPILL CLEANUP,
0523 OIL SPILLS, USCG, TANKERS, REGULATIONS, PERSONNEL TRAINING, STANDARDS, POLLUTION PREVENTION, *NAVIGATION AIDS,
0529 OIL SPILLS, MASSACHUSETTS, MARSHES, FUEL OIL, CRUSTACEANS, CHRONIC EFFECTS, TOXICITY, *UCA PAGNAX,
0539 OIL SPILLS, MORTALITY, MOLLUSKS, MAINE, BIOLOGICAL EFFECTS, *CLAMS,
0566 OIL SPILLS, FRESHWATER, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ARCTIC, PLANKTON , *INSECTS, *COASTAL TUNDRA PONDS,
0588 OIL SPILLS, MOLLUSKS, FUEL OIL, FRANCE, CONTAMINATION, UPTAKE, RELEASE, *PORT DE BOUC SPILL, *MUSSELS,
0589 OIL SPILLS, MOVEMENT, ICE, FATE, BEHAVIOR, SPREADING, MASSACHUSSETTS, *BUZZARDS BAY,
0590 OIL SPILLS, MARINE ORGANISMS, ECONOMIC EFFECTS, COMPENSATION, CALIFORNIA, *MONETARY VALUES,
0605 OIL SPILLS, OFFSHORE DEVELOPMENT, NORTH SEA, FISHERIES, ECONOMIC EFFECTS, COST ANALYSIS,
0607 OIL SPILLS, OIL DISCHARGES, JAPAN, ECOSYSTEMS, SHIPS, WATER QUALITY, *TOKYO BAY,
0609 OIL SPILLS, OIL SLICKS, FATE, BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES, POLLUTION CONTROL, RED SEA,
0616 OIL SPILLS, GUIDELINES, FATE, ENVIRONMENTAL EFFECTS, BEHAVIOR, BEAUFORT SEA, ARCTIC, *SCIENTIFIC RESPONSE STUDIES,
0623 OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS, POLLUTION CONTROL, TANKERS, PLATFORMS, REFINERIES, PETROCHEMICALS,
0628 OIL SPILLS, OFFSHORE DEVELOPMENT, NORTH SEA, SANTA BARBARA CHANNEL, *CELTIC SEA, *GEOLOGIC CONDITIONS,
0653 OIL SPILLS, GEORGES BANK, BEACHES, ATLANTIC COAST, STATISTICAL ANALYSIS, USGS,
0663 OIL SPILLS, BIODEGRADATION, AROMATIC HYDROCARBONS, ARCTIC, WEATHERING, TOXICITY,
R021 OIL SPILLS, ANALYTICAL TECHNIQUES, MONITORING, MANUALS, SOURCE IDENTIFICATION, EPA,
R022 OIL SPILLS, MONITORING, DETECTION, US, *ALARM SYSTEM,
0400 OIL TANKS, EQUIPMENT, OIL-WATER SEPARATION, SKIMMERS, PRODUCT INFORMATION,
0420 OIL TANKS, EMULSIONS, ABSORPTION, SPILL CLEANUP, POLLUTION PREVENTION, *DETERGENTS,
0433 OIL TANKS, JAPAN, STORAGE, POLLUTION PREVENTION, *AIR CUSHION MOVEMENT ,
0443 OIL TANKS, CONTAMINATION, STORAGE, *CORROSION,
0512 OIL TANKS, MONITORING, EQUIPMENT, DESIGN-ENGINEERING, POLLUTION PREVENTION, PRODUCT INFORMATION, *OPTIC LIQUID LEVEL SENSOR,
0518 OIL TANKS, CRUDE OIL, BALLAST , TANKERS, POLLUTION PREVENTION, *LOAD-ON-TOP, *CRUDE OIL WASHING,
R036 OIL TANKS, ECONOMICS, WASTEWATER TREATMENT, REUSE, RECLAMATION, TOXICITY, *TANK TRUCK WASHING,
0572 OIL TERMINALS, MOLLUSKS, INTERTIDAL ZONE, DISTRIBUTION, CHRONIC EFFECTS, BASELINE STUDIES, ALASKA, *MACOMA BALTHICA,
0637 OIL TERMINALS, OFFSHORE DRILLING, NORTH SEA, BIOLOGICAL EFFECTS, TANKERS, PORTS, SOURCES, UK, *CELTIC SEA,
0675 OIL TERMINALS, OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, US, TANKERS, *OIL SPILL FUND,

0678 OIL TERMINALS, GUIDELINES, POLLUTION PREVENTION, WASTEWATERS, SAFETY, *FLOATING RECEPTION FACILITIES,
0434 OIL TRANSFER, HARBORS, ENVIRONMENTAL EFFECTS, PORTS, STATISTICS, POLLUTION CONTROL, UK, *MILFORD HAVEN,
0500 OIL TRANSFER, ENVIRONMENTAL PROTECTION, PERSONNEL TRAINING, REGULATIONS, USCG, *PERSONNEL QUALIFICATIONS,
0508 OIL TRANSFER, OIL DISCHARGES, PERSONNEL TRAINING, TANKERS, POLLUTION PREVENTION, SAFETY, REGULATIONS,
0435 OIL TRANSPORT, EPA, ENVIRONMENTAL DETERIORATION, ALASKA, PIPELINES, TANKERS, WATER QUALITY, US,
0440 OIL TRANSPORT, FUEL OIL, PETROLEUM PRODUCTS, STORAGE, REFINING, OIL SPILLS, FUELS ,
0527 OIL TRANSPORT, COST ANALYSIS, SHIPS, POLLUTION PREVENTION, SPILL CLEANUP, PORTS, SAFETY,
0600 OIL TRANSPORT, OCEANS, HYDROCARBONS , PETROLEUM PRODUCTS, SEA SURFACE, *AIR-SEA INTERFACE,
R051 OIL TRANSPORT, OFFSHORE DRILLING, MARINE ORGANISMS, EXTRACTION, BIOLOGICAL EFFECTS, PETROCHEMICALS, TOXICITY, *DRILLING MUDS,
0400 OIL-WATER SEPARATION, OIL TANKS, EQUIPMENT, SKIMMERS, PRODUCT INFORMATION,
0406 OIL-WATER SEPARATION, OIL SLICKS, SPILL CLEANUP, SPILL RECOVERY, PATENT,
0450 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, PATENT,
0457 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT,
0459 OIL-WATER SEPARATION, FILTRATION , WASTEWATER TREATMENT, *POLYURETHANE FOAM,
0467 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PRECIPITATION, PATENT,
0476 OIL-WATER SEPARATION, OIL INDUSTRY, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, PETROCHEMICALS, *REVIEW,
0479 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *CENTRIFUGAL SEPARATION,
0480 OIL-WATER SEPARATION, LUBRICATING OIL, FUELS , FILTRATION , BILGES, SHIPS,
0481 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT, *PURIFICATION,
0482 OIL-WATER SEPARATION, EXTRACTION, DISTILLATION, SOLVENTS, PETROLEUM PRODUCTS, WASTEWATERS,
0483 OIL-WATER SEPARATION, ADSORPTION, PATENT,
0484 OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, PATENT, *POLYETHLYLENE,
0485 OIL-WATER SEPARATION, FILTRATION , AROMATIC HYDROCARBONS, WASTEWATER TREATMENT, PETROCHEMICALS,
0486 OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, PATENT, *DIATOMITE, *ZEOLITE,
0487 OIL-WATER SEPARATION, BILGES, WASTEWATERS, FILTRATION , PATENT, *POLYPROPYLENE FIBER,
0488 OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, PETROLEUM PRODUCTS, WASTEWATERS, PATENT, *SEPARATION TANK,
0489 OIL-WATER SEPARATION, ADSORPTION, ABSORPTION, PATENT, *SILICATE SORBENTS,
0490 OIL-WATER SEPARATION, ADSORPTION, PATENT, *FIBER SHEET, *TURBINE OIL,
0491 OIL-WATER SEPARATION, FILTRATION , WASTEWATERS, PATENT, *PVC MEMBRANE,
0492 OIL-WATER SEPARATION, INCINERATION, FLOCCULATION, FILTRATION , EMULSIONS, *COMPRESSOR DRAINS,
0493 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, SURFACTANTS,
0494 OIL-WATER SEPARATION, *MINERAL OIL, *POLYETHYLENE SCRAPS,
0495 OIL-WATER SEPARATION, FLOCCULATION, WASTEWATERS, PATENT, *THIOLIGNIN ACID,
0496 OIL-WATER SEPARATION, ADSORPTION, PATENT, *FIBERS,
0694 OIL-WATER SEPARATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, SPILL CLEANUP, SPREADING,
R037 OIL-WATER SEPARATION, EQUIPMENT, DESIGN-ENGINEERING, *REVIEW,
0624 ONSHORE IMPACTS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, SOCIO-ECONOMIC EFFECTS, UK, *SHETLAND ISLANDS,
0630 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, NORTH SEA, ENVIRONMENTAL EFFECTS, UK,
0449 OXIDATION, INDUSTRIES, BIODEGRADATION, ADSORPTION, PETROCHEMICALS, WASTEWATER TREATMENT, *ACTIVATED CARBON,
0451 OXIDATION, REFINERIES, WASTEWATER TREATMENT, *BIOCHEMICAL TREATMENT,
0478 OXIDATION, REFINERIES, WASTEWATER TREATMENT, *AERATION PONDS,
0410 PACIFIC OCEAN, PRODUCT INFORMATION, SPILL RECOVERY, SKIMMERS, *CLEAN SWEEP SKIMMER,
0606 PACIFIC OCEAN, INDUSTRIES, HYDROCARBONS , FISH, FATE, CONTAMINANTS, BIOLOGICAL EFFECTS,
0343 PAH, CONTAMINATION, CARCINOGENS, SAMPLING, *CONTAMINANT REMOVAL,
0360 PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS,
0364 PAH, EXTRACTION, CHROMATOGRAPHY, *HPLC, *LITERATURE SURVEY,
0368 PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOLUBILITY,
0549 PAH, HEALTH HAZARDS, FOOD WEB, CONTAMINATION, CARCINOGENS, PETROLEUM PRODUCTS,
0698 PAH, CHEMICAL ANALYSIS, CARCINOGENS,
0705 PAH, HEALTH HAZARDS, EXTRACTION, CARCINOGENS, WATER QUALITY, *CHLORINATION,
R023 PAH, MONITORING, HYDROCARBONS , SAMPLING, WATER QUALITY, *QUALITY CONTROL SAMPLES,
0327 PATENT, MONITORING, DETECTION, SAMPLING, PETROLEUM PRODUCTS, WASTEWATERS,
0328 PATENT, MONITORING, DETECTION, PETROLEUM PRODUCTS, POLLUTION PREVENTION,
0329 PATENT, MONITORING, EMULSIONS, DETECTION, *OIL IN WATER, *PHOTOSENSOR,
0334 PATENT, MONITORING, FUEL OIL, DETECTION, SLUDGE, *UV FLUORESCENCE,
0385 PATENT, EQUIPMENT, BOOMS, SPILL CONTAINMENT,
0388 PATENT, EQUIPMENT, BOOMS, SPILL CONTAINMENT,
0463 PATENT, EQUIPMENT, ABSORPTION, SPILL CLEANUP, *POLYPROPYLENE,
0404 PATENT, DISPERSANTS, SPILL CLEANUP,

0406 PATENT, OIL-WATER SEPARATION, OIL SLICKS, SPILL CLEANUP, SPILL RECOVERY,
0407 PATENT, SPILL RECOVERY, SEAWATER, WASTEWATERS, *POWDERED PLASTICS, *FOAM,
0408 PATENT, MARINE ORGANISMS, SPILL CLEANUP, PETROLEUM PRODUCTS,
0412 PATENT, EQUIPMENT, SPILL CLEANUP, *PLASTIC DISKS,
0413 PATENT, FRESHWATER, DISPERSANTS, BACTERIA, PETROLEUM PRODUCTS, SPILL CLEANUP, SEAWATER,
0414 PATENT, BOOMS, SPILL CLEANUP, *WATER SPRAY BOOMS ,
0415 PATENT, ABSORPTION, SPILL CLEANUP, *PINE CHIPS,
0417 PATENT, ADSORPTION, SPILL CLEANUP, *PINE CHIPS,
0421 PATENT, ABSORPTION, SPILL CLEANUP, *COCONUT SHELL,
0422 PATENT, EQUIPMENT, BOOMS, PETROLEUM PRODUCTS, SPILL CLEANUP, *CRYOTHERMAL MATERIAL,
0425 PATENT, ADSORPTION, SPILL CLEANUP, *SORBENT FOAM,
0427 PATENT, ADSORPTION, SEAWATER, *RESIN FILAMENT,
0450 PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT,
0452 PATENT, EMULSIONS, WASTEWATER TREATMENT, SURFACTANTS,
0456 PATENT, EMULSIONS, ABSORPTION, WASTEWATER TREATMENT, PRECIPITATION,
0457 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT,
0464 PATENT, ADSORPTION, WASTE OIL TREATMENT, SPILL CLEANUP, SPILL DISPOSAL, *MAGNETIC POWDER,
0467 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PRECIPITATION,
0471 PATENT, FILTRATION , WASTEWATER TREATMENT, SURFACTANTS,
0479 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *CENTRIFUGAL SEPARATION,
0481 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, *PURIFICATION,
0483 PATENT, OIL-WATER SEPARATION, ADSORPTION,
0484 PATENT, OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, *POLYETHLYLENE,
0486 PATENT, OIL-WATER SEPARATION, ADSORPTION, WASTEWATERS, *DIATOMITE, *ZEOLITE,
0487 PATENT, OIL-WATER SEPARATION, BILGES, WASTEWATERS, FILTRATION , *POLYPROPYLENE FIBER,
0488 PATENT, OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, PETROLEUM PRODUCTS, WASTEWATERS, *SEPARATION TANK,
0489 PATENT, OIL-WATER SEPARATION, ADSORPTION, ABSORPTION, *SILICATE SORBENTS,
0490 PATENT, OIL-WATER SEPARATION, ADSORPTION, *FIBER SHEET, *TURBINE OIL,
0491 PATENT, OIL-WATER SEPARATION, FILTRATION , WASTEWATERS, *PVC MEMBRANE,
0495 PATENT, OIL-WATER SEPARATION, FLOCCULATION, WASTEWATERS, *THIOLIGNIN ACID,
0496 PATENT, OIL-WATER SEPARATION, ADSORPTION, *FIBERS,
0498 PATENT, LUBRICATING OIL, WASTE OIL, RECLAMATION, SLUDGE ,
0499 PATENT, LUBRICATING OIL, WASTE OIL, RECLAMATION,
0500 PERSONNEL TRAINING, OIL TRANSFER, ENVIRONMENTAL PROTECTION, REGULATIONS, USCG, *PERSONNEL QUALIFICATIONS,
0501 PERSONNEL TRAINING, COASTS, CANADA, SPILL CLEANUP, *ONSHORE CLEANUP,
0502 PERSONNEL TRAINING, POLLUTION CONTROL, SPILL CLEANUP,
0503 PERSONNEL TRAINING, OIL SPILLS, INLAND, INFORMATION SYSTEMS, CONTINGENCY PLANNING, CANADA, POLLUTION PREVENTION,
0504 PERSONNEL TRAINING, COASTS, CANADA, BEACHES, SPILL CLEANUP, RESTORATION, *PRINCE EDWARD ISLAND, *SEMINAR,
0505 PERSONNEL TRAINING, POLLUTION PREVENTION, SHIPS, TANKERS, REGULATIONS,
0506 PERSONNEL TRAINING, CONTINGENCY PLANNING, POLLUTION CONTROL, SPILL CLEANUP, *OIL SPILL CONTROL COURSE,
0507 PERSONNEL TRAINING, NOAA, EQUIPMENT, EPA, COMPENSATION, ALASKA, SPILL CLEANUP,
0508 PERSONNEL TRAINING, OIL TRANSFER, OIL DISCHARGES, TANKERS, POLLUTION PREVENTION, SAFETY, REGULATIONS,
0509 PERSONNEL TRAINING, BOOMS, SPILL CLEANUP, PRODUCT INFORMATION, POLLUTION CONTROL, *VIKOMA OCEANPACK,
0514 PERSONNEL TRAINING, MONITORING, PORTS, TANKERS, POLLUTION CONTROL, SAFETY, *EXXON,
0520 PERSONNEL TRAINING, INLAND, EQUIPMENT, DISPERSANTS, SPILL CLEANUP, PETROLEUM PRODUCTS, *SORBENTS, *FIRE-FIGHTING,
0523 PERSONNEL TRAINING, OIL SPILLS, USCG, TANKERS, REGULATIONS, STANDARDS, POLLUTION PREVENTION, *NAVIGATION AIDS,
R038 PERSONNEL TRAINING, INFORMATION SYSTEMS, TANKERS, STATISTICS, *TANKER CASUALTIES, *COMPUTER SERVICES,
0447 PETROCHEMICALS, OIL SPILLS, MICROORGANISMS, INDUSTRIES, BIODEGRADATION, WASTEWATER TREATMENT, WASTE OIL TREATMENT,
0449 PETROCHEMICALS, OXIDATION, INDUSTRIES, BIODEGRADATION, ADSORPTION, WASTEWATER TREATMENT, *ACTIVATED CARBON,
0461 PETROCHEMICALS, CONTAMINATION, WASTEWATER TREATMENT, *STEAM CONDENSATE REUSE ,
0463 PETROCHEMICALS, OIL INDUSTRY, JAPAN, BIODEGRADATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT,
0476 PETROCHEMICALS, OIL-WATER SEPARATION, OIL INDUSTRY, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, *REVIEW,
0485 PETROCHEMICALS, OIL-WATER SEPARATION, FILTRATION , AROMATIC HYDROCARBONS, WASTEWATER TREATMENT,
0623 PETROCHEMICALS, OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS, POLLUTION CONTROL, TANKERS, PLATFORMS, REFINERIES,
R051 PETROCHEMICALS, OIL TRANSPORT, OFFSHORE DRILLING, MARINE ORGANISMS, EXTRACTION, BIOLOGICAL EFFECTS, TOXICITY, *DRILLING MUDS,
0327 PETROLEUM PRODUCTS, PATENT, MONITORING, DETECTION, SAMPLING, WASTEWATERS,
0328 PETROLEUM PRODUCTS, PATENT, MONITORING, DETECTION, POLLUTION PREVENTION,

0359 PETROLEUM PRODUCTS, MARINE ORGANISMS, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, *BIOGENIC HYDROCARBONS,
0362 PETROLEUM PRODUCTS, EQUIPMENT, CHEMICAL ANALYSIS, SPECTROSCOPY,
0371 PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, ADSORPTION, SOIL,
0408 PETROLEUM PRODUCTS, PATENT, MARINE ORGANISMS, SPILL CLEANUP,
0413 PETROLEUM PRODUCTS, PATENT, FRESHWATER, DISPERSANTS, BACTERIA, SPILL CLEANUP, SEAWATER,
0422 PETROLEUM PRODUCTS, PATENT, EQUIPMENT, BOOMS, SPILL CLEANUP, *CRYOTHERMAL MATERIAL,
0440 PETROLEUM PRODUCTS, OIL SPILLS, FUELS , FUEL OIL, STORAGE, OIL TRANSPORT, REFINING,
0482 PETROLEUM PRODUCTS, OIL-WATER SEPARATION, EXTRACTION, DISTILLATION, SOLVENTS, WASTEWATERS,
0488 PETROLEUM PRODUCTS, PATENT, OIL-WATER SEPARATION, FILTRATION , EQUIPMENT, WASTEWATERS, *SEPARATION TANK,
0520 PETROLEUM PRODUCTS, PERSONNEL TRAINING, INLAND, EQUIPMENT, DISPERSANTS, SPILL CLEANUP, *SORBENTS, *FIRE-FIGHTING,
0531 PETROLEUM PRODUCTS, MOLLUSKS, UPTAKE, *OXYGEN DEMAND,
0534 PETROLEUM PRODUCTS, MICROORGANISMS, BIOLOGICAL EFFECTS, SURFACTANTS,
0549 PETROLEUM PRODUCTS, PAH, HEALTH HAZARDS, FOOD WEB, CONTAMINATION, CARCINOGENS,
0550 PETROLEUM PRODUCTS, HEALTH HAZARDS, CARCINOGENS, AROMATIC HYDROCARBONS,
0561 PETROLEUM PRODUCTS, ECHINODERMS, DISPERSANTS, *SEA URCHINS, TOXICITY, *BIO-INDICATORS,
0563 PETROLEUM PRODUCTS, METABOLISM, INVERTEBRATES, FISH, CHRONIC EFFECTS, ACUTE EFFECTS, TOXICITY,
0568 PETROLEUM PRODUCTS, EUROPE, DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY,
0571 PETROLEUM PRODUCTS, EUROPE, DISPERSANTS, BOOK REVIEW, ANALYTICAL TECHNIQUES, TOXICITY,
0584 PETROLEUM PRODUCTS, MORTALITY, MICROORGANISMS, INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ALGAE,
0597 PETROLEUM PRODUCTS, MONITORING, ENVIRONMENTAL EFFECTS, DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCES,
0599 PETROLEUM PRODUCTS, MORTALITY, CARCINOGENS, BIODEGRADATION, SUBLETHAL EFFECTS, UPTAKE, RELEASE,
0600 PETROLEUM PRODUCTS, OIL TRANSPORT, OCEANS, HYDROCARBONS , SEA SURFACE, *AIR-SEA INTERFACE,
0602 PETROLEUM PRODUCTS, NORWAY, CONTAMINATION, SEDIMENTS,
0608 PETROLEUM PRODUCTS, OCEANS, MARINE ORGANISMS, HYDROCARBONS , FATE, ARCTIC, SUBARCTIC REGIONS, SOURCES,
0612 PETROLEUM PRODUCTS, CONTAMINATION, BLACK SEA, SEAWATER, *BULGARIA,
0614 PETROLEUM PRODUCTS, FISHERIES, FISH, CONTAMINATION, COASTS, ATLANTIC COAST, *MIDDLE ATLANTIC BIGHT,
0673 PETROLEUM PRODUCTS, MODELS, GROUNDWATER, CONTAMINATION, *HYDRODYNAMICS,
R024 PETROLEUM PRODUCTS, DISPERSIONS, CHEMICAL ANALYSIS, SAMPLING, *QUANTITATION,
R026 PETROLEUM PRODUCTS, FRESHWATER, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SEDIMENTS, SEAWATER, *IN SITU ANALYSIS,
R045 PETROLEUM PRODUCTS, MORTALITY, MARINE ORGANISMS, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY, SUBLETHAL EFFECTS,
R046 PETROLEUM PRODUCTS, OIL SHALE, FISH, DETECTION, CARCINOGENS, *BIOASSAY,
0598 PHYSICAL EFFECTS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, SOURCES, HYDROCARBONS ,
0639 PHYSICAL EFFECTS, OIL SLICKS, CHEMICAL EFFECTS, SEA SURFACE, *SURFACE FILMS, *GAS EXCHANGE,
0650 PHYSICAL EFFECTS, MOVEMENT, HYDROCARBONS , GROUNDWATER, FRESHWATER, WASTEWATERS, *AQUIFER,
0659 PHYSICAL EFFECTS, MICROORGANISMS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIODEGRADATION, ARCTIC,
0667 PHYSICAL EFFECTS, HYDROCARBONS , FATE, WEATHERING, *POLLUTANT TRANSFER,
0709 PHYSICAL EFFECTS, MODELS, COASTS, STATISTICAL ANALYSIS, POLLUTION PREVENTION, RESOURCE MANAGEMENT, *POLLUTION SUSCEPTIBILITY,
R056 PHYSICAL EFFECTS, OIL SLICKS, DISPERSIONS, *LITERATURE SURVEY,
0645 PHYTOPLANKTON, FUEL OIL, ECOSYSTEMS, DISTRIBUTION, BIODEGRADATION, ZOOPLANKTON,
0661 PHYTOPLANKTON, AROMATIC HYDROCARBONS, FATE, BIODEGRADATION, CRUSTACEANS, SEDIMENTATION, *NAPHTHALENES,
0435 PIPELINES, OIL TRANSPORT, EPA, ENVIRONMENTAL DETERIORATION, ALASKA, TANKERS, WATER QUALITY, US,
0515 PIPELINES, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, BLOWOUT PREVENTION, ARCTIC, US, POLLUTION PREVENTION, SPILL CLEANUP,
R032 PIPELINES, OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING, POLLUTION PREVENTION,
R033 PIPELINES, MONITORING, FISH, BIOLOGICAL EFFECTS, ALASKA, WATER QUALITY, STREAMS, *TAPS,
R039 PIPELINES, OFFSHORE DEVELOPMENT, LEAKAGE, INLAND, ENVIRONMENTAL PROTECTION, DETECTION, DESIGN-ENGINEERING,
0353 PLANKTON , INVERTEBRATES, HYDROCARBONS , FISH, CHROMATOGRAPHY, SAMPLING, UK, *N-ALKANES,
0566 PLANKTON , OIL SPILLS, FRESHWATER, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ARCTIC, *INSECTS, *COASTAL TUNDRA PONDS,
0576 PLANKTON , MODELS, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS,
0668 PLANKTON , BEHAVIOR, ADSORPTION, ABSORPTION, *BENZENE,
0623 PLATFORMS, PETROCHEMICALS, OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS, POLLUTION CONTROL, TANKERS, REFINERIES,

0319 POLAND, COASTS, BIRDS, BALTIC SEA, SAMPLING, STATISTICS,
0585 POLAND, MORTALITY, COASTS, BIRDS, BIOLOGICAL EFFECTS, BALTIC SEA, *CLANGULA HYEMALIS,
0312 POLLUTION CONTROL, FATE, EVAPORATION, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT,
0314 POLLUTION CONTROL, CONTAMINATION, COASTS, AFRICA,
0315 POLLUTION CONTROL, HYDROCARBONS , ECUADOR, DETECTION,
0323 POLLUTION CONTROL, MONITORING, EQUIPMENT, BALLAST , PRODUCT INFORMATION, *BABCOCK CONTROLS,
0326 POLLUTION CONTROL, MONITORING, DISPERSANTS, DETECTION, CHEMICAL ANALYSIS, TOXICITY, *BIOASSAY,
0375 POLLUTION CONTROL, SOURCE IDENTIFICATION, USCG,
0383 POLLUTION CONTROL, EQUIPMENT, BOOMS, SPILL CONTAINMENT, PRODUCT INFORMATION, TANKERS, *LUCAN BOOM,
0390 POLLUTION CONTROL, EQUIPMENT, BOOMS, SPILL CONTAINMENT, PRODUCT INFORMATION, *VATOR OY CO,
0432 POLLUTION CONTROL, REGULATIONS, USCG, TANKERS, SEGREGATED BALLAST, *DOUBLE BOTTOMS, *EMERGENCY STEERING,
0434 POLLUTION CONTROL, OIL TRANSFER, HARBORS, ENVIRONMENTAL EFFECTS, PORTS, STATISTICS, UK, *MILFORD HAVEN,
0454 POLLUTION CONTROL, MONITORING, ANALYTICAL TECHNIQUES, SHIPS, *ENZYME TECHNOLOGY,
0462 POLLUTION CONTROL, HYDROCARBONS , GROUNDWATER, SOIL, WASTEWATER TREATMENT, *FUEL DEPOTS,
0472 POLLUTION CONTROL, OIL SHALE, ENVIRONMENTAL EFFECTS, DISPOSAL , SOLID WASTES, TAR SANDS, *SYNFUELS,
0502 POLLUTION CONTROL, PERSONNEL TRAINING, SPILL CLEANUP,
0506 POLLUTION CONTROL, PERSONNEL TRAINING, CONTINGENCY PLANNING, SPILL CLEANUP, *OIL SPILL CONTROL COURSE,
0509 POLLUTION CONTROL, PERSONNEL TRAINING, BOOMS, SPILL CLEANUP, PRODUCT INFORMATION, *VIKOMA OCEANPACK,
0514 POLLUTION CONTROL, PERSONNEL TRAINING, MONITORING, PORTS, TANKERS, SAFETY, *EXXON,
0519 POLLUTION CONTROL, OIL SHALE, EXTRACTION, EPA, DEVELOPMENT , WATER QUALITY, SOLID WASTES, *RESEARCH PROGRAMS,
0522 POLLUTION CONTROL, MEDITERRANEAN SEA, HYDROCARBONS , CHRONIC EFFECTS, TAR, TANKERS, SOURCES,
0524 POLLUTION CONTROL, INDUSTRIES, ENVIRONMENTAL EFFECTS, COST ANALYSIS,
0525 POLLUTION CONTROL, INDUSTRIES, COST ANALYSIS,
0538 POLLUTION CONTROL, MICROORGANISMS, HEALTH HAZARDS, *MICROBIOLOGICAL ASPECTS,
0591 POLLUTION CONTROL, OIL DISCHARGES, ILLINOIS, ECONOMIC EFFECTS, REGULATIONS, *HEXANES,
0592 POLLUTION CONTROL, OIL INDUSTRY, IMCO, EQUIPMENT, REGULATIONS, USCG,
0596 POLLUTION CONTROL, LEGISLATION, CONTAMINATION, SOURCES,
0609 POLLUTION CONTROL, OIL SPILLS, OIL SLICKS, FATE, BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES, RED SEA,
0611 POLLUTION CONTROL, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, ECOSYSTEMS,
0615 POLLUTION CONTROL, OCEANS, MONITORING, HYDROCARBONS , ENVIRONMENTAL EFFECTS, UN,
0623 POLLUTION CONTROL, PLATFORMS, PETROCHEMICALS, OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS, TANKERS, REFINERIES,
0631 POLLUTION CONTROL, LEGISLATION, ENVIRONMENTAL EFFECTS, CRUDE OIL, *COASTAL ZONE MANAGEMENT, *CONFERENCE,
0646 POLLUTION CONTROL, MICROORGANISMS, FUELS , CRUDE OIL, BIODEGRADATION, SEAWATER,
0670 POLLUTION CONTROL, MODELS, ESTUARIES, SOURCE IDENTIFICATION, SAMPLING,
0676 POLLUTION CONTROL, LEGISLATION, INTERNATIONAL AGREEMENTS, CONTAMINANTS, BOOK REVIEW,
0682 POLLUTION CONTROL, INTERNATIONAL AGREEMENTS, GREAT LAKES, CANADA, WATER QUALITY, US,
0683 POLLUTION CONTROL, INTERNATIONAL CONVENTIONS, *RATIFICATION,
0685 POLLUTION CONTROL, INDUSTRIES, COST ANALYSIS, BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT,
0686 POLLUTION CONTROL, INDUSTRIES, COST ANALYSIS, BIBLIOGRAPHIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT,
0687 POLLUTION CONTROL, INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, *OZONE,
0688 POLLUTION CONTROL, INDUSTRIES, EQUIPMENT, BIBLIOGRAPHIES, WASTEWATER TREATMENT, *OZONE,
0689 POLLUTION CONTROL, INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, *MEMBRANES,
0690 POLLUTION CONTROL, INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, *MEMBRANES,
0691 POLLUTION CONTROL, INDUSTRIES, DESIGN-ENGINEERING, BIBLIOGRAPHIES, WASTEWATER TREATMENT, ULTRAFILTRATION, *MEMBRANES,
0692 POLLUTION CONTROL, GUIDELINES, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, BIBLIOGRAPHIES, WASTEWATER TREATMENT, STANDARDS,
0693 POLLUTION CONTROL, INDUSTRIES, ECONOMICS, COST ANALYSIS, BIBLIOGRAPHIES, WASTEWATER TREATMENT,
0702 POLLUTION CONTROL, INDUSTRIES, EQUIPMENT, WASTEWATERS,
0707 POLLUTION CONTROL, INDUSTRIES, GOVERNMENT AGENCIES, REGULATIONS,
0328 POLLUTION PREVENTION, PETROLEUM PRODUCTS, PATENT, MONITORING, DETECTION,
0420 POLLUTION PREVENTION, OIL TANKS, EMULSIONS, ABSORPTION, SPILL CLEANUP, *DETERGENTS,
0433 POLLUTION PREVENTION, JAPAN, OIL TANKS, STORAGE, *AIR CUSHION MOVEMENT ,
0442 POLLUTION PREVENTION, DESIGN-ENGINEERING, TANKERS, SAFETY, SURVEILLANCE, US,

0470 POLLUTION PREVENTION, OIL DISCHARGES, BALLAST , TANKERS, SLUDGE , *CRUDE OIL WASHING,
0503 POLLUTION PREVENTION, PERSONNEL TRAINING, OIL SPILLS, INLAND, INFORMATION SYSTEMS, CONTINGENCY PLANNING, CANADA,
0505 POLLUTION PREVENTION, PERSONNEL TRAINING, SHIPS, TANKERS, REGULATIONS,
0508 POLLUTION PREVENTION, PERSONNEL TRAINING, OIL TRANSFER, OIL DISCHARGES, TANKERS, SAFETY, REGULATIONS,
0511 POLLUTION PREVENTION, DESIGN-ENGINEERING, TANKERS, *ANTI-POLLUTION VALVE,
0512 POLLUTION PREVENTION, OIL TANKS, MONITORING, EQUIPMENT, DESIGN-ENGINEERING, PRODUCT INFORMATION, *OPTIC LIQUID LEVEL SENSOR,
0513 POLLUTION PREVENTION, DESIGN-ENGINEERING, TANKERS,
0515 POLLUTION PREVENTION, PIPELINES, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, BLOWOUT PREVENTION, ARCTIC, US, SPILL CLEANUP,
0518 POLLUTION PREVENTION, OIL TANKS, CRUDE OIL, BALLAST , TANKERS, *LOAD-ON-TOP, *CRUDE OIL WASHING,
0521 POLLUTION PREVENTION, INTERNATIONAL AGREEMENTS, TANKERS, SEGREGATED BALLAST, *CRUDE OIL WASHING,
0523 POLLUTION PREVENTION, PERSONNEL TRAINING, OIL SPILLS, USCG, TANKERS, REGULATIONS, STANDARDS, *NAVIGATION AIDS,
0527 POLLUTION PREVENTION, OIL TRANSPORT, COST ANALYSIS, SHIPS, SPILL CLEANUP, PORTS, SAFETY,
0528 POLLUTION PREVENTION, MEDITERRANEAN SEA, ENVIRONMENTAL PROTECTION, UN,
0594 POLLUTION PREVENTION, NORTH SEA, CONTINGENCY PLANNING, BLOWOUTS, REGULATIONS, SAFETY, UK,
0636 POLLUTION PREVENTION, OFFSHORE DRILLING, OCS, DESIGN-ENGINEERING, ATLANTIC OCEAN, RESOURCE MANAGEMENT, *WORKSHOP,
0678 POLLUTION PREVENTION, OIL TERMINALS, GUIDELINES, WASTEWATERS, SAFETY, *FLOATING RECEPTION FACILITIES,
0681 POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, TANKERS,
0701 POLLUTION PREVENTION, WASTEWATER TREATMENT, REFINERIES, *CYANIDE REMOVAL, *POWDERED ACTIVATED CARBON,
0709 POLLUTION PREVENTION, PHYSICAL EFFECTS, MODELS, COASTS, STATISTICAL ANALYSIS, RESOURCE MANAGEMENT, *POLLUTION SUSCEPTIBILITY,
R030 POLLUTION PREVENTION, OCEANS, FRESHWATER, SPILL RECOVERY, *AMINE CARBAMATE GELATION TECHNIQUES,
R032 POLLUTION PREVENTION, PIPELINES, OFFSHORE DEVELOPMENT, DESIGN-ENGINEERING,
0577 POLYCHAETES, FUEL OIL, CRUDE OIL, WSF, TOXICITY, SUBLETHAL EFFECTS, *NEANTHES ARENACEODENTATA,
0350 PORTS, MOLLUSKS, INTERTIDAL ZONE, DISTRIBUTION, BASELINE STUDIES, ALASKA, SAMPLING, *MACOMA BALTHICA,
0434 PORTS, POLLUTION CONTROL, OIL TRANSFER, HARBORS, ENVIRONMENTAL EFFECTS, STATISTICS, UK, *MILFORD HAVEN,
0514 PORTS, POLLUTION CONTROL, PERSONNEL TRAINING, MONITORING, TANKERS, SAFETY, *EXXON,
0527 PORTS, POLLUTION PREVENTION, OIL TRANSPORT, COST ANALYSIS, SHIPS, SPILL CLEANUP, SAFETY,
0633 PORTS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, ONSHORE EFFECTS, TEXAS, *SUPERPORTS
0637 PORTS, OIL TERMINALS, OFFSHORE DRILLING, NORTH SEA, BIOLOGICAL EFFECTS, TANKERS, SOURCES, UK, *CELTIC SEA,
0456 PRECIPITATION, PATENT, EMULSIONS, ABSORPTION, WASTEWATER TREATMENT,
0467 PRECIPITATION, PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT,
0322 PRODUCT INFORMATION, MONITORING, DETECTION, DESIGN-ENGINEERING, BILGES, BALLAST , SHIPS, *OIL CONTENT ANALYSER,
0323 PRODUCT INFORMATION, POLLUTION CONTROL, MONITORING, EQUIPMENT, BALLAST , *BABCOCK CONTROLS,
0335 PRODUCT INFORMATION, MONITORING, EQUIPMENT, DETECTION, *INFRARED DETECTORS,
0373 PRODUCT INFORMATION, ANALYTICAL TECHNIQUES, *OIL-IN-WATER ANALYSIS, *PHOTOMETERS, *TELEDYNE,
0383 PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, BOOMS, SPILL CONTAINMENT, TANKERS, *LUCAN BOOM,
0386 PRODUCT INFORMATION, BOOMS, SPILL CONTAINMENT, *BOA-BOOM II,
0387 PRODUCT INFORMATION, DESIGN-ENGINEERING, SPILL CONTAINMENT, *OIL COLLECTANT DISPENSER,
0390 PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, BOOMS, SPILL CONTAINMENT, *VATOR OY CO,
0391 PRODUCT INFORMATION, ABSORPTION, SPILL CLEANUP, *FORBENT,
0392 PRODUCT INFORMATION, DESIGN-ENGINEERING, SPILL RECOVERY, STORAGE, *DRACONE BARGE,
0393 PRODUCT INFORMATION, EQUIPMENT, SKIMMERS, SPILL RECOVERY, UK,
0394 PRODUCT INFORMATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, *EUROSKIMMER,
0395 PRODUCT INFORMATION, NORTH SEA, EQUIPMENT, EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY,
0396 PRODUCT INFORMATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL RECOVERY, *FIELD TESTING,
0399 PRODUCT INFORMATION, NORTH SEA, EKOFISK BLOWOUT, SKIMMERS, SPILL RECOVERY, *FRAMO SKIMMER,
0400 PRODUCT INFORMATION, OIL-WATER SEPARATION, OIL TANKS, EQUIPMENT, SKIMMERS,
0402 PRODUCT INFORMATION, DISPERSANTS, SPILL CLEANUP,
0405 PRODUCT INFORMATION, SPILL CLEANUP, *HELLE ENGINEERING, *FLOTATION SUPPORT,

0409 PRODUCT INFORMATION, ALASKA/GULF OF, SKIMMERS, SPILL RECOVERY, *CLEAN SWEEP SKIMMER,
0410 PRODUCT INFORMATION, PACIFIC OCEAN, SPILL RECOVERY, SKIMMERS, *CLEAN SWEEP SKIMMER,
0423 PRODUCT INFORMATION, SKIMMERS, SPILL CLEANUP, *SKIM INC,
0424 PRODUCT INFORMATION, ABSORPTION, SPILL CLEANUP, *TREE BARK CHIPS,
0426 PRODUCT INFORMATION, ABSORPTION, SPILL CLEANUP, *VISCOUS OIL SORBENT TYPE 356,
0428 PRODUCT INFORMATION, EQUIPMENT, BOOMS, SPILL CLEANUP, *VIKCMA OCEANPACK,
0509 PRODUCT INFORMATION, POLLUTION CONTROL, PERSONNEL TRAINING, BOOMS, SPILL CLEANUP, *VIKOMA OCEANPACK,
0512 PRODUCT INFORMATION, POLLUTION PREVENTION, OIL TANKS, MONITORING, EQUIPMENT, DESIGN-ENGINEERING, *OPTIC LIQUID LEVEL SENSOR,
0517 PRODUCT INFORMATION, SAFETY, TANKERS, *GEC MECHANICS HANDLING LTD, *COUPLING,
0526 PRODUCT INFORMATION, BLOWOUT PREVENTION, SAFETY, *M&M 2000T SERIES NEEDLE VALVE,
0377 PRODUCTION , MISSISSIPPI RIVER, MEXICO/GULF OF, HYDROCARBONS , SOURCE IDENTIFICATION,
0445 RECLAMATION, EPA, ENVIRONMENTAL EFFECTS, ECONOMICS, DISPOSAL , WASTE OIL, RECYCLING,
0455 RECLAMATION, INDUSTRIES, DISPOSAL , BIODEGRADATION, WASTE OIL TREATMENT, WASTEWATER TREATMENT,
0469 RECLAMATION, CONTAMINATION, WASTE OIL, REFINING, *COMBUSTION,
0497 RECLAMATION, FUEL OIL, WASTE OIL, RECYCLING, WASTEWATER TREATMENT, *CENTRIFUGATION,
0498 RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL, SLUDGE ,
0499 RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL,
R036 RECLAMATION, OIL TANKS, ECONOMICS, WASTEWATER TREATMENT, REUSE, TOXICITY, *TANK TRUCK WASHING,
0444 RECYCLING, WASTEWATER TREATMENT, WASTE OILS, REUSE, *THERMAL PROCESS,
0445 RECYCLING, RECLAMATION, EPA, ENVIRONMENTAL EFFECTS, ECONOMICS, DISPOSAL , WASTE OIL,
0497 RECYCLING, RECLAMATION, FUEL OIL, WASTE OIL, WASTEWATER TREATMENT, *CENTRIFUGATION,
0609 RED SEA, POLLUTION CONTROL, OIL SPILLS, OIL SLICKS, FATE, BIOLOGICAL EFFECTS, BEHAVIOR, SOURCES,
0451 REFINERIES, OXIDATION, WASTEWATER TREATMENT, *BIOCHEMICAL TREATMENT,
0458 REFINERIES, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
0460 REFINERIES, FLOTATION, FLOCCULATION, EMULSIONS, WASTEWATER TREATMENT, *COAGULATION,
0465 REFINERIES, MICHIGAN, GREAT LAKES, DISPOSAL , DISPERSIONS, COASTS, WASTEWATERS, SPREADING,
0468 REFINERIES, MICROORGANISMS, WASTEWATER TREATMENT, *TEMPERATURE EFFECTS,
0473 REFINERIES, INDUSTRIES, WASTEWATER TREATMENT,
0474 REFINERIES, FLOTATION, WASTEWATER TREATMENT, SEDIMENTATION,
0478 REFINERIES, OXIDATION, WASTEWATER TREATMENT, *AERATION PONDS,
0621 REFINERIES, EPA, DEVELOPMENT , VIRGINIA, *JAMES RIVER,
0623 REFINERIES, POLLUTION CONTROL, PLATFORMS, PETROCHEMICALS, OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS, TANKERS,
0629 REFINERIES, CONTAMINATION, CHRONIC EFFECTS, BENTHOS, WASTEWATERS,
0701 REFINERIES, POLLUTION PREVENTION, WASTEWATER TREATMENT, *CYANIDE REMOVAL, *POWDERED ACTIVATED CARBON,
R034 REFINERIES, ADSORPTION, WASTEWATER TREATMENT, TOXICITY, *ACTIVATED CARBON, *BIOASSAY,
R035 REFINERIES, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, *GC/MS,
0440 REFINING, PETROLEUM PRODUCTS, OIL SPILLS, FUELS , FUEL OIL, STORAGE, OIL TRANSPORT,
0469 REFINING, RECLAMATION, CONTAMINATION, WASTE OIL, *COMBUSTION,
0432 REGULATIONS, POLLUTION CONTROL, USCG, TANKERS, SEGREGATED BALLAST, *DOUBLE BOTTOMS, *EMERGENCY STEERING,
0441 REGULATIONS, IMCO, DESIGN-ENGINEERING, BALLAST , TANKERS, *COMPUTER METHODS,
0500 REGULATIONS, PERSONNEL TRAINING, OIL TRANSFER, ENVIRONMENTAL PROTECTION, USCG, *PERSONNEL QUALIFICATIONS,
0505 REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, SHIPS, TANKERS,
0508 REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, OIL TRANSFER, OIL DISCHARGES, TANKERS, SAFETY,
0523 REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, OIL SPILLS, USCG, TANKERS, STANDARDS, *NAVIGATION AIDS,
0591 REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES, ILLINOIS, ECONOMIC EFFECTS, *HEXANES,
0592 REGULATIONS, POLLUTION CONTROL, OIL INDUSTRY, IMCO, EQUIPMENT, USCG,
0594 REGULATIONS, POLLUTION PREVENTION, NORTH SEA, CONTINGENCY PLANNING, BLOWOUTS, SAFETY, UK,
0627 REGULATIONS, OFFSHORE DRILLING, OCS, GOVERNMENT AGENCIES, ENVIRONMENTAL EFFECTS, CANADA, *LABRADOR SEA,
0674 REGULATIONS, LEGISLATION, TANKERS, DESIGN-ENGINEERING, SAFETY, US, SEGREGATED BALLAST,
0707 REGULATIONS, POLLUTION CONTROL, INDUSTRIES, GOVERNMENT AGENCIES,
0533 RELEASE, MARINE ORGANISMS, CHEMICAL ANALYSIS, HYDROCARBONS , TOXICITY, UPTAKE, WSF,
0552 RELEASE, FISH, DISPERSANTS, CALIFORNIA, BIOLOGICAL EFFECTS, BIODEGRADATION, SPILL CLEANUP, UPTAKE,
0587 RELEASE, MOLLUSKS, METABOLISM, FISHERIES, CONTAMINATION, CHROMATOGRAPHY, *MUSSEL CULTURES,
0588 RELEASE, OIL SPILLS, MOLLUSKS, FUEL OIL, FRANCE, CONTAMINATION, UPTAKE, *PORT DE BOUC SPILL, *MUSSELS,
0599 RELEASE, PETROLEUM PRODUCTS, MORTALITY, CARCINOGENS, BIODEGRADATION, SUBLETHAL EFFECTS, UPTAKE,
0336 REMOTE SENSING, OIL SPILLS, MONITORING, EPA, *LANDSAT, *ENVIRO-POD,
0337 REMOTE SENSING, OIL SLICKS, MONITORING, BLOWOUTS, *NASA HEAT CAPACITY MAPPING MISSION,

0338 REMOTE SENSING, MONITORING, ESTUARIES, DISPERSIONS, DETECTION,
0339 REMOTE SENSING, OIL SPILLS, DETECTION, ANALYTICAL TECHNIQUES, *BACKSCATTERING TECHNIQUES,
0530 REPRODUCTION, FUEL OIL, CRUDE OIL, BIRDS, BIOLOGICAL EFFECTS, *EGG HATCHABILITY,
0532 REPRODUCTION, METABOLISM, MARINE ORGANISMS, GROWTH, FUEL OIL, CRUDE OIL,
0636 RESOURCE MANAGEMENT, POLLUTION PREVENTION, OFFSHORE DRILLING, OCS, DESIGN-ENGINEERING, ATLANTIC OCEAN, *WORKSHOP,
0706 RESOURCE MANAGEMENT, INDUSTRIES, ECOSYSTEMS,
0709 RESOURCE MANAGEMENT, POLLUTION PREVENTION, PHYSICAL EFFECTS, MODELS, COASTS, STATISTICAL ANALYSIS, *POLLUTION SUSCEPTIBILITY,
0429 RESTORATION, OIL SPILLS, MANUALS, BIRDS, *CARE & TREATMENT,
0430 RESTORATION, MANUALS, GUIDELINES, BIRDS, WILDLIFE, *OILED ANIMALS , *CARE & TREATMENT,
0431 RESTORATION, OIL SPILLS, ECOSYSTEMS, BOOK REVIEW, *ECOLOGICAL DISASTERS,
0504 RESTORATION, PERSONNEL TRAINING, COASTS, CANADA, BEACHES, SPILL CLEANUP, *PRINCE EDWARD ISLAND, *SEMINAR,
0626 RESTORATION, OIL SHALE, HEALTH HAZARDS, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT CONTAMINATION, SOCIO-ECONOMIC EFFECTS,
R031 RESTORATION, MANUALS, EQUIPMENT, SPILL CLEANUP, SHORELINES, ENVIRONMENTAL PROTECTION, *FIELD METHODS,
0444 REUSE, RECYCLING, WASTEWATER TREATMENT, WASTE OILS, *THERMAL PROCESS,
R036 REUSE, RECLAMATION, OIL TANKS, ECONOMICS, WASTEWATER TREATMENT, TOXICITY, *TANK TRUCK WASHING,
0442 SAFETY, POLLUTION PREVENTION, DESIGN-ENGINEERING, TANKERS, SURVEILLANCE, US,
0508 SAFETY, REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, OIL TRANSFER, OIL DISCHARGES, TANKERS,
0514 SAFETY, PORTS, POLLUTION CONTROL, PERSONNEL TRAINING, MONITORING, TANKERS, *EXXON,
0517 SAFETY, PRODUCT INFORMATION, TANKERS, *GEC MECHANICS HANDLING LTD, *COUPLING,
0526 SAFETY, PRODUCT INFORMATION, BLOWOUT PREVENTION, *M&M 2000T SERIES NEEDLE VALVE,
0527 SAFETY, PORTS, POLLUTION PREVENTION, OIL TRANSPORT, COST ANALYSIS, SHIPS, SPILL CLEANUP,
0594 SAFETY, REGULATIONS, POLLUTION PREVENTION, NORTH SEA, CONTINGENCY PLANNING, BLOWOUTS, UK,
0635 SAFETY, OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN,
0674 SAFETY, REGULATIONS, LEGISLATION, TANKERS, DESIGN-ENGINEERING, US, SEGREGATED BALLAST,
0678 SAFETY, POLLUTION PREVENTION, OIL TERMINALS, GUIDELINES, WASTEWATERS, *FLOATING RECEPTION FACILITIES,
0319 SAMPLING, POLAND, COASTS, BIRDS, BALTIC SEA, STATISTICS,
0320 SAMPLING, OIL SLICKS, NATURAL SEEPAGE, CANADA, *BAFFIN ISLAND,
0325 SAMPLING, MONITORING, HYDROCARBONS , FINLAND, COASTS, SEAWATER,
0327 SAMPLING, PETROLEUM PRODUCTS, PATENT, MONITORING, DETECTION, WASTEWATERS,
0340 SAMPLING, OCEANS, NEUSTON, INDIAN OCEAN, DISTRIBUTION, ATLANTIC OCEAN, TAR, *NEUSTONIC PERIPHYTON,
0341 SAMPLING, HYDROCARBONS , CHEMICAL ANALYSIS, BALTIC SEA,
0342 SAMPLING, OCEANS, EQUIPMENT, CHEMICAL ANALYSIS, TAR, *PLASTICS, *LITTER,
0343 SAMPLING, PAH, CONTAMINATION, CARCINOGENS, *CONTAMINANT REMOVAL,
0344 SAMPLING, DISTRIBUTION, CHROMATOGRAPHY, ATLANTIC OCEAN, TAR, *COMPOSITION, *WEIGHT,
0345 SAMPLING, HYDROCARBONS , DISTRIBUTION, CHROMATOGRAPHY, SEA SURFACE, SEAWATER, SEDIMENTS, *N-ALKANES,
0346 SAMPLING, NATURAL SEEPAGE, HYDROCARBONS , DETECTION, COASTS, *TAIWAN,
0347 SAMPLING, INVERTEBRATES, HYDROCARBONS , GREENLAND, FISH, COASTS, SEDIMENTS,
0348 SAMPLING, EXTRACTION, CONTAMINATION, SEAWATER, *N-ALKANE ANALYSES,
0349 SAMPLING, OCEANS, HYDROCARBONS , BASELINE STUDIES, SEA SURFACE, *COASTAL WATERS, *SHIPPING LANES,
0350 SAMPLING, PORTS, MOLLUSKS, INTERTIDAL ZONE, DISTRIBUTION, BASELINE STUDIES, ALASKA, *MACOMA BALTHICA,
0351 SAMPLING, OIL FIELDS, HYDROCARBONS , WASTEWATERS, *ORGANIC COMPOUNDS,
0352 SAMPLING, MARINE ORGANISMS, HYDROCARBONS , FATE, BENTHOS, SEDIMENTS, UPTAKE,
0353 SAMPLING, PLANKTON , INVERTEBRATES, HYDROCARBONS , FISH, CHROMATOGRAPHY, UK, *N-ALKANES,
0354 SAMPLING, HYDROCARBONS , ATLANTIC OCEAN, *NOVA SCOTIA, *GULF STREAM, *BIOGENIC HYDROCARBONS,
0369 SAMPLING, CHEMICAL ANALYSIS, BOOK REVIEW, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION,
0570 SAMPLING, MOLLUSKS, HYDROCARBONS , CHROMATOGRAPHY, SEDIMENTS, *PECTEN YESSOENSIS,
0601 SAMPLING, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, SOURCES, *REVIEW,
0664 SAMPLING, FATE, DECOMPOSITION, TAR, SARGASSO SEA, SOURCE IDENTIFICATION,
0670 SAMPLING, POLLUTION CONTROL, MODELS, ESTUARIES, SOURCE IDENTIFICATION,
R023 SAMPLING, PAH, MONITORING, HYDROCARBONS , WATER QUALITY, *QUALITY CONTROL SAMPLES,
R024 SAMPLING, PETROLEUM PRODUCTS, DISPERSIONS, CHEMICAL ANALYSIS, *QUANTITATION,
R025 SAMPLING, OIL DISCHARGES, MARINE ORGANISMS, CHRONIC EFFECTS, CHEMICAL ANALYSIS, ACUTE EFFECTS, SEAWATER, SEDIMENTS, TOXICITY,
0628 SANTA BARBARA CHANNEL, OIL SPILLS, OFFSHORE DEVELOPMENT, NORTH SEA, *CELTIC SEA, *GEOLOGIC CONDITIONS,
0370 SARGASSO SEA, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, TAR,
0569 SARGASSO SEA, HYDROCARBONS , FOOD WEB, CONTAMINATION, *TRANSFER , *BIOGENIC HYDROCARBONS,

0662 SARGASSO SEA, FATE, DISTRIBUTION, ATLANTIC OCEAN, TAR, SEA SURFACE, *NORTH ATLANTIC,
0664 SARGASSO SEA, SAMPLING, FATE, DECOMPOSITION, TAR, SOURCE IDENTIFICATION,
0666 SARGASSO SEA, FATE, DISTRIBUTION, CHROMATOGRAPHY, TAR, SOURCE IDENTIFICATION, WEATHERING,
0345 SEA SURFACE, SAMPLING, HYDROCARBONS , DISTRIBUTION, CHROMATOGRAPHY, SEAWATER, SEDIMENTS, *N-ALKANES,
0349 SEA SURFACE, SAMPLING, OCEANS, HYDROCARBONS , BASELINE STUDIES, *COASTAL WATERS, *SHIPPING LANES,
0600 SEA SURFACE, PETROLEUM PRODUCTS, OIL TRANSPORT, OCEANS, HYDROCARBONS , *AIR-SEA INTERFACE,
0639 SEA SURFACE, PHYSICAL EFFECTS, OIL SLICKS, CHEMICAL EFFECTS, *SURFACE FILMS, *GAS EXCHANGE,
0648 SEA SURFACE, MODELS, HYDROCARBONS , EVAPORATION, TAR, WEATHERING,
0651 SEA SURFACE, FUEL OIL, FATE, CRUDE OIL, CHROMATOGRAPHY, SPECTROSCOPY, *REFRACTIVE INDEX,
0652 SEA SURFACE, FUEL OIL, FATE, CRUDE OIL, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES,
0662 SEA SURFACE, SARGASSO SEA, FATE, DISTRIBUTION, ATLANTIC OCEAN, TAR, *NORTH ATLANTIC,
0325 SEAWATER, SAMPLING, MONITORING, HYDROCARBONS , FINLAND, COASTS,
0345 SEAWATER, SEA SURFACE, SAMPLING, HYDROCARBONS , DISTRIBUTION, CHROMATOGRAPHY, SEDIMENTS, *N-ALKANES,
0348 SEAWATER, SAMPLING, EXTRACTION, CONTAMINATION, *N-ALKANE ANALYSES,
0356 SEAWATER, HYDROCARBONS , DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SURFACTANTS,
0407 SEAWATER, PATENT, SPILL RECOVERY, WASTEWATERS, *POWDERED PLASTICS, *FOAM,
0413 SEAWATER, PETROLEUM PRODUCTS, PATENT, FRESHWATER, DISPERSANTS, BACTERIA, SPILL CLEANUP,
0427 SEAWATER, PATENT, ADSORPTION, *RESIN FILAMENT,
0612 SEAWATER, PETROLEUM PRODUCTS, CONTAMINATION, BLACK SEA, *BULGARIA,
0641 SEAWATER, MICROORGANISMS, HYDROCARBONS , CRUDE OIL, BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, SEDIMENTS,
0646 SEAWATER, POLLUTION CONTROL, MICROORGANISMS, FUELS , CRUDE OIL, BIODEGRADATION,
0649 SEAWATER, FUEL OIL, EMULSIONS, CHEMICAL ANALYSIS, WEATHERING,
R025 SEAWATER, SAMPLING, OIL DISCHARGES, MARINE ORGANISMS, CHRONIC EFFECTS, CHEMICAL ANALYSIS, ACUTE EFFECTS, SEDIMENTS, TOXICITY,
R026 SEAWATER, PETROLEUM PRODUCTS, FRESHWATER, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, SEDIMENTS, *IN SITU ANALYSIS,
0474 SEDIMENTATION, REFINERIES, FLOTATION, WASTEWATER TREATMENT,
0603 SEDIMENTATION, METULA SPILL, MAGELLAN/STRAIT OF, COASTS, SEDIMENTS, *GEOMORPHOLOGY,
0661 SEDIMENTATION, FATE, CRUSTACEANS, BIODEGRADATION, AROMATIC HYDROCARBONS, PHYTOPLANKTON, *NAPHTHALENES,
0672 SEDIMENTATION, MODELS, HYDROCARBONS , FRESHWATER, DISPERSIONS, *COAGULATION,
0345 SEDIMENTS, SEAWATER, SEA SURFACE, SAMPLING, HYDROCARBONS , DISTRIBUTION, CHROMATOGRAPHY, *N-ALKANES,
0347 SEDIMENTS, SAMPLING, INVERTEBRATES, HYDROCARBONS , GREENLAND, FISH, COASTS,
0352 SEDIMENTS, SAMPLING, MARINE ORGANISMS, HYDROCARBONS , FATE, BENTHOS, UPTAKE,
0367 SEDIMENTS, DETECTION, CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, *THERMAL ANALYSIS,
0570 SEDIMENTS, SAMPLING, MOLLUSKS, HYDROCARBONS , CHROMATOGRAPHY, *PECTEN YESSOENSIS,
0575 SEDIMENTS, MARINE ORGANISMS, ICE, ECOSYSTEMS, CRUDE OIL, ARCTIC, TOXICITY, WEATHERING,
0602 SEDIMENTS, PETROLEUM PRODUCTS, NORWAY, CONTAMINATION,
0603 SEDIMENTS, SEDIMENTATION, METULA SPILL, MAGELLAN/STRAIT OF, COASTS, *GEOMORPHOLOGY,
0617 SEDIMENTS, NOAA, MARINE ORGANISMS, FISH, CHRONIC EFFECTS, ARGO MERCHANT SPILL,
0638 SEDIMENTS, HYDROCARBONS , FISH, CONTAMINATION, BENTHOS, *PETROLEUM TAINTS,
0641 SEDIMENTS, SEAWATER, MICROORGANISMS, HYDROCARBONS , CRUDE OIL, BIODEGRADATION, BACTERIA, ATLANTIC OCEAN,
0647 SEDIMENTS, MICROORGANISMS, CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS,
R025 SEDIMENTS, SEAWATER, SAMPLING, OIL DISCHARGES, MARINE ORGANISMS, CHRONIC EFFECTS, CHEMICAL ANALYSIS, ACUTE EFFECTS, TOXICITY,
R026 SEDIMENTS, SEAWATER, PETROLEUM PRODUCTS, FRESHWATER, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES, *IN SITU ANALYSIS,
R049 SEDIMENTS, METULA SPILL, MAGELLAN/STRAIT OF, CONTAMINATION, BIOLOGICAL EFFECTS, BENTHOS,
0432 SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, USCG, TANKERS, *DOUBLE BOTTOMS, *EMERGENCY STEERING,
0521 SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL AGREEMENTS, TANKERS, *CRUDE OIL WASHING,
0674 SEGREGATED BALLAST, SAFETY, REGULATIONS, LEGISLATION, TANKERS, DESIGN-ENGINEERING, US,
0322 SHIPS, PRODUCT INFORMATION, MONITORING, DETECTION, DESIGN-ENGINEERING, BILGES, BALLAST *OIL CONTENT ANALYSER,
0333 SHIPS, DETECTION, DESIGN-ENGINEERING, BILGES, MONITORING, *CARBON ANALYSIS,
0454 SHIPS, POLLUTION CONTROL, MONITORING, ANALYTICAL TECHNIQUES, *ENZYME TECHNOLOGY,
0480 SHIPS, OIL-WATER SEPARATION, LUBRICATING OIL, FUELS , FILTRATION , BILGES,
0505 SHIPS, REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, TANKERS,
0527 SHIPS, SAFETY, PORTS, POLLUTION PREVENTION, OIL TRANSPORT, COST ANALYSIS, SPILL CLEANUP,

0607 SHIPS, OIL SPILLS, OIL DISCHARGES, JAPAN, ECOSYSTEMS, WATER QUALITY, *TOKYO BAY,
0595 SHORELINES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, COASTS, UK, TOXICITY,
R031 SHORELINES, RESTORATION, MANUALS, EQUIPMENT, SPILL CLEANUP, ENVIRONMENTAL PROTECTION, *FIELD METHODS,
0654 SINKING AGENTS, FATE, DISPERSANTS, CONTAMINATION, BIODEGRADATION, SOURCES, SPILL CLEANUP,
0393 SKIMMERS, PRODUCT INFORMATION, EQUIPMENT, SPILL RECOVERY, UK,
0394 SKIMMERS, PRODUCT INFORMATION, EQUIPMENT, DESIGN-ENGINEERING, SPILL CLEANUP, *EUROSKIMMER,
0395 SKIMMERS, PRODUCT INFORMATION, NORTH SEA, EQUIPMENT, EKOFISK BLOWOUT, SPILL RECOVERY,
0398 SKIMMERS, EQUIPMENT, EKOFISK BLOWOUT, DISPERSANTS,
0399 SKIMMERS, PRODUCT INFORMATION, NORTH SEA, EKOFISK BLOWOUT, SPILL RECOVERY, *FRAMO SKIMMER,
0400 SKIMMERS, PRODUCT INFORMATION, OIL-WATER SEPARATION, OIL TANKS, EQUIPMENT,
0409 SKIMMERS, PRODUCT INFORMATION, ALASKA/GULF OF, SPILL RECOVERY, *CLEAN SWEEP SKIMMER,
0410 SKIMMERS, PRODUCT INFORMATION, PACIFIC OCEAN, SPILL RECOVERY, *CLEAN SWEEP SKIMMER,
0419 SKIMMERS, HARBORS, EPA, BOOMS, SPILL CLEANUP, SPILL RECOVERY, *TESTS,
0423 SKIMMERS, PRODUCT INFORMATION, SPILL CLEANUP, *SKIM INC,
R027 SKIMMERS, EPA, SPILL RECOVERY, *TESTING, *OHMSETT,
R029 SKIMMERS, EPA, SPILL CLEANUP, *TESTING, *OHMSETT,
0470 SLUDGE , POLLUTION PREVENTION, OIL DISCHARGES, BALLAST , TANKERS, *CRUDE OIL WASHING,
0498 SLUDGE , RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL,
0437 SOCIO-ECONOMIC EFFECTS, EIS, STORAGE, WATER QUALITY, *STRATEGIC PETROLEUM RESERVE,
0624 SOCIO-ECONOMIC EFFECTS, ONSHORE IMPACTS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, NORTH SEA, UK, *SHETLAND ISLANDS,
0626 SOCIO-ECONOMIC EFFECTS, RESTORATION, OIL SHALE, HEALTH HAZARDS, EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT , CONTAMINATION,
0633 SOCIO-ECONOMIC EFFECTS, PORTS, ENVIRONMENTAL EFFECTS, ONSHORE EFFECTS, TEXAS, *SUPERPORTS ,
0371 SOIL, PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, ADSORPTION,
0462 SOIL, POLLUTION CONTROL, HYDROCARBONS , GROUNDWATER, WASTEWATER TREATMENT, *FUEL DEPOTS,
0644 SOIL, HYDROCARBONS , FUNGI, BIODEGRADATION, BACTERIA, *LEAD,
0656 SOIL, HYDROCARBONS , FATE, BIODEGRADATION,
R057 SOIL, OIL SHALE, MODELS, FATE, WASTEWATERS, SOURCES, *POLLUTANT TRANSPORT,
0472 SOLID WASTES, POLLUTION CONTROL, OIL SHALE, ENVIRONMENTAL EFFECTS, DISPOSAL , TAR SANDS, *SYNFUELS,
0519 SOLID WASTES, POLLUTION CONTROL, OIL SHALE, EXTRACTION, EPA, DEVELOPMENT , WATER QUALITY, *RESEARCH PROGRAMS,
0368 SOLUBILITY, PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
0482 SOLVENTS, PETROLEUM PRODUCTS, OIL-WATER SEPARATION, EXTRACTION, DISTILLATION, WASTEWATERS,
0358 SOURCE IDENTIFICATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *LUMINESCENCE ANALYSIS,
0363 SOURCE IDENTIFICATION, HYDROCARBONS , DISPERSIONS, CHEMICAL ANALYSIS,
0367 SOURCE IDENTIFICATION, SEDIMENTS, DETECTION, CRUDE OIL, ANALYTICAL TECHNIQUES, *THERMAL ANALYSIS,
0369 SOURCE IDENTIFICATION, SAMPLING, CHEMICAL ANALYSIS, BOOK REVIEW, ANALYTICAL TECHNIQUES,
0370 SOURCE IDENTIFICATION, SARGASSO SEA, CHEMICAL ANALYSIS, TAR,
0374 SOURCE IDENTIFICATION, OIL SLICKS, WEATHERING, SPECTROSCOPY,
0375 SOURCE IDENTIFICATION, POLLUTION CONTROL, USCG,
0376 SOURCE IDENTIFICATION, CONNECTICUT, COMPENSATION, CHEMICAL ANALYSIS, USCG,
0377 SOURCE IDENTIFICATION, PRODUCTION , MISSISSIPPI RIVER, MEXICO/GULF OF, HYDROCARBONS ,
0378 SOURCE IDENTIFICATION, DETECTION, SPECTROSCOPY, *UV FLUORESCENCE,
0379 SOURCE IDENTIFICATION, OIL SPILLS, *SPLITLESS INJECTION,
0380 SOURCE IDENTIFICATION, HYDROCARBONS , CONTAMINANTS, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES,
0381 SOURCE IDENTIFICATION, FUELS , CRUDE OIL, CHROMATOGRAPHY,
0382 SOURCE IDENTIFICATION, OIL SPILLS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, USCG, SPECTROSCOPY,
0664 SOURCE IDENTIFICATION, SARGASSO SEA, SAMPLING, FATE, DECOMPOSITION, TAR,
0666 SOURCE IDENTIFICATION, SARGASSO SEA, FATE, DISTRIBUTION, CHROMATOGRAPHY, TAR, WEATHERING,
0670 SOURCE IDENTIFICATION, SAMPLING, POLLUTION CONTROL, MODELS, ESTUARIES,
R021 SOURCE IDENTIFICATION, MONITORING, MANUALS, EPA, ANALYTICAL TECHNIQUES, OIL SPILLS,
0522 SOURCES, POLLUTION CONTROL, MEDITERRANEAN SEA, HYDROCARBONS , CHRONIC EFFECTS, TAR, TANKERS,
0593 SOURCES, OFFSHORE PRODUCTION, MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, SUBLETHAL EFFECTS, *SYMPOSIUM,
0596 SOURCES, POLLUTION CONTROL, LEGISLATION, CONTAMINATION,
0597 SOURCES, PETROLEUM PRODUCTS, MONITORING, ENVIRONMENTAL EFFECTS, DETECTION, CRUDE OIL, CHEMICAL ANALYSIS, BIBLIOGRAPHIES,
0598 SOURCES, PHYSICAL EFFECTS, FATE, CRUDE OIL, CHEMICAL EFFECTS, BIOLOGICAL EFFECTS, HYDROCARBONS ,
0601 SOURCES, SAMPLING, HYDROCARBONS , FATE, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, *REVIEW,
0604 SOURCES, OIL INDUSTRY, NATURAL SEEPAGE, INLAND, ENVIRONMENTAL EFFECTS, TANKERS, WATER QUALITY,

0608 SOURCES, PETROLEUM PRODUCTS, OCEANS, MARINE ORGANISMS, HYDROCARBONS , FATE, ARCTIC, SUBARCTIC REGIONS,
0609 SOURCES, RED SEA, POLLUTION CONTROL, OIL SPILLS, OIL SLICKS, FATE, BIOLOGICAL EFFECTS, BEHAVIOR,
0637 SOURCES, PORTS, OIL TERMINALS, OFFSHORE DRILLING, NORTH SEA, BIOLOGICAL EFFECTS, TANKERS, UK, *CELTIC SEA,
0654 SOURCES, SINKING AGENTS, FATE, DISPERSANTS, CONTAMINATION, BIODEGRADATION, SPILL CLEANUP,
0660 SOURCES, FATE, ARGO MERCHANT SPILL, TORREY CANYON, *FLORIDA,
R057 SOURCES, SOIL, OIL SHALE, MODELS, FATE, WASTEWATERS, *POLLUTANT TRANSPORT,
0554 SPECTROMETRY, CRUDE OIL, CHROMATOGRAPHY, BIRDS, AROMATIC HYDROCARBONS, UPTAKE, *ANAS PLATYRHYNCHOS,
0555 SPECTROMETRY, HYDROCARBONS , CRUDE OIL, CHROMATOGRAPHY, BIRDS, *ANAS PLATYRHYNCHOS,
0362 SPECTROSCOPY, PETROLEUM PRODUCTS, EQUIPMENT, CHEMICAL ANALYSIS,
0374 SPECTROSCOPY, SOURCE IDENTIFICATION, OIL SLICKS, WEATHERING,
0378 SPECTROSCOPY, SOURCE IDENTIFICATION, DETECTION, *UV FLUORESCENCE,
0382 SPECTROSCOPY, SOURCE IDENTIFICATION, OIL SPILLS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, USCG,
0573 SPECTROSCOPY, MOLLUSKS, CRUDE OIL, CHROMATOGRAPHY, UPTAKE, *OYSTERS, *SULFUR COMPOUNDS,
0651 SPECTROSCOPY, SEA SURFACE, FUEL OIL, FATE, CRUDE OIL, CHROMATOGRAPHY, *REFRACTIVE INDEX,
0313 SPILL CLEANUP, OIL SPILLS, MORTALITY, FUEL OIL, FISH, *ADRIAN MAERSK, *HONG KONG,
0318 SPILL CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, STATISTICS, *COMPUTER DIRECTORY,
0321 SPILL CLEANUP, NORWAY, NORTH SEA, ENVIRONMENTAL EFFECTS, EKOFISK BLOWOUT, CRUDE OIL,
0391 SPILL CLEANUP, PRODUCT INFORMATION, ABSORPTION, *FORBENT,
0394 SPILL CLEANUP, SKIMMERS, PRODUCT INFORMATION, EQUIPMENT, DESIGN-ENGINEERING, *EUROSKIMMER,
0397 SPILL CLEANUP, USCG, *SEAWARD INTERNATIONAL INC, *ROUGH WEATHER RESPONSE,
0401 SPILL CLEANUP, FUEL OIL, ABSORPTION, *POLYURETHANE FOAM,
0402 SPILL CLEANUP, PRODUCT INFORMATION, DISPERSANTS,
0403 SPILL CLEANUP, PATENT, EQUIPMENT, ABSORPTION, *POLYPROPYLENE,
0404 SPILL CLEANUP, PATENT, DISPERSANTS,
0405 SPILL CLEANUP, PRODUCT INFORMATION, *HELLE ENGINEERING, *FLOTATION SUPPORT,
0406 SPILL CLEANUP, PATENT, OIL-WATER SEPARATION, OIL SLICKS, SPILL RECOVERY,
0408 SPILL CLEANUP, PETROLEUM PRODUCTS, PATENT, MARINE ORGANISMS,
0411 SPILL CLEANUP, OIL INDUSTRY, GOVERNMENT AGENCIES, DISPERSANTS, CONTINGENCY PLANNING, AUSTRALIA,
0412 SPILL CLEANUP, PATENT, EQUIPMENT, *PLASTIC DISKS,
0413 SPILL CLEANUP, SEAWATER, PETROLEUM PRODUCTS, PATENT, FRESHWATER, DISPERSANTS, BACTERIA,
0414 SPILL CLEANUP, PATENT, BOOMS, *WATER SPRAY BOOMS ,
0415 SPILL CLEANUP, PATENT, ABSORPTION, *PINE CHIPS,
0416 SPILL CLEANUP, ADSORPTION, PATENT *PINE PULP,
0417 SPILL CLEANUP, PATENT, ADSORPTION, *PINE CHIPS,
0419 SPILL CLEANUP, SKIMMERS, HARBORS, EPA, BOOMS, SPILL RECOVERY, *TESTS,
0420 SPILL CLEANUP, POLLUTION PREVENTION, OIL TANKS, EMULSIONS, ABSORPTION, *DETERGENTS,
0421 SPILL CLEANUP, PATENT, ABSORPTION, *COCONUT SHELL,
0422 SPILL CLEANUP, PETROLEUM PRODUCTS, PATENT, EQUIPMENT, BOOMS, *CRYOTHERMAL MATERIAL,
0423 SPILL CLEANUP, SKIMMERS, PRODUCT INFORMATION, *SKIM INC,
0424 SPILL CLEANUP, PRODUCT INFORMATION, ABSORPTION, *TREE BARK CHIPS,
0425 SPILL CLEANUP, PATENT, ADSORPTION, *SORBENT FOAM,
0426 SPILL CLEANUP, PRODUCT INFORMATION, ABSORPTION, *VISCOUS OIL SORBENT TYPE 356,
0428 SPILL CLEANUP, PRODUCT INFORMATION, EQUIPMENT, BOOMS, *VIKOMA OCEANPACK,
0464 SPILL CLEANUP, PATENT, ADSORPTION, WASTE OIL TREATMENT, SPILL DISPOSAL, *MAGNETIC POWDER,
0501 SPILL CLEANUP, PERSONNEL TRAINING, COASTS, CANADA, *ONSHORE CLEANUP,
0502 SPILL CLEANUP, POLLUTION CONTROL, PERSONNEL TRAINING,
0504 SPILL CLEANUP, RESTORATION, PERSONNEL TRAINING, COASTS, CANADA, BEACHES, *PRINCE EDWARD ISLAND, *SEMINAR,
0506 SPILL CLEANUP, POLLUTION CONTROL, PERSONNEL TRAINING, CONTINGENCY PLANNING, *OIL SPILL CONTROL COURSE,
0507 SPILL CLEANUP, PERSONNEL TRAINING, NOAA, EQUIPMENT, EPA, COMPENSATION, ALASKA,
0509 SPILL CLEANUP, PRODUCT INFORMATION, POLLUTION CONTROL, PERSONNEL TRAINING, BOOMS, *VIKOMA OCEANPACK,
0510 SPILL CLEANUP, OIL SPILLS, INTERTIDAL ZONE, CONTINGENCY PLANNING, COASTS, CANADA,
0515 SPILL CLEANUP, POLLUTION PREVENTION, PIPELINES, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, BLOWOUT PREVENTION, ARCTIC, US,
0516 SPILL CLEANUP, MORTALITY, MANUALS, WILDLIFE,
0520 SPILL CLEANUP, PETROLEUM PRODUCTS, PERSONNEL TRAINING, INLAND, EQUIPMENT, DISPERSANTS, *SORBENTS, *FIRE-FIGHTING,
0527 SPILL CLEANUP, SHIPS, SAFETY, PORTS, POLLUTION PREVENTION, OIL TRANSPORT, COST ANALYSIS,
0552 SPILL CLEANUP, RELEASE, FISH, DISPERSANTS, CALIFORNIA, BIOLOGICAL EFFECTS, BIODEGRADATION, UPTAKE,
0654 SPILL CLEANUP, SOURCES, SINKING AGENTS, FATE, DISPERSANTS, CONTAMINATION, BIODEGRADATION,

0669 SPILL CLEANUP, OIL SLICKS, MODELS, FATE, *THEORETICAL PREDICTIONS,
0694 SPILL CLEANUP, OIL-WATER SEPARATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES, SPREADING,
R028 SPILL CLEANUP, EPA, ENVIRONMENTAL EFFECTS, *TESTING, *OHMSETT,
R029 SPILL CLEANUP, SKIMMERS, EPA, *TESTING, *OHMSETT,
R031 SPILL CLEANUP, SHORELINES, RESTORATION, MANUALS, EQUIPMENT, ENVIRONMENTAL PROTECTION, *FIELD METHODS,
0383 SPILL CONTAINMENT, PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, BOOMS, TANKERS, *LUCAN BOOM,
0384 SPILL CONTAINMENT, MODELS, *HYDRODYNAMICS,
0385 SPILL CONTAINMENT, PATENT, EQUIPMENT, BOOMS,
0386 SPILL CONTAINMENT, PRODUCT INFORMATION, BOOMS, *BOA-BOOM II,
0387 SPILL CONTAINMENT, PRODUCT INFORMATION, DESIGN-ENGINEERING, *OIL COLLECTANT DISPENSER,
0388 SPILL CONTAINMENT, PATENT, EQUIPMENT, BOOMS,
0390 SPILL CONTAINMENT, PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, BOOMS, *VATOR OY
0708 SPILL CONTAINMENT, ICE, BEAUFORT SEA, *TOPOGRAPHY,
0464 SPILL DISPOSAL, SPILL CLEANUP, PATENT, ADSORPTION, WASTE OIL TREATMENT, *MAGNETIC POWDER,
0392 SPILL RECOVERY, PRODUCT INFORMATION, DESIGN-ENGINEERING, STORAGE, *DRACONE BARGE,
0393 SPILL RECOVERY, SKIMMERS, PRODUCT INFORMATION, EQUIPMENT, UK,
0395 SPILL RECOVERY, SKIMMERS, PRODUCT INFORMATION, NORTH SEA, EQUIPMENT, EKOFISK BLOWOUT,
0396 SPILL RECOVERY, PRODUCT INFORMATION, EQUIPMENT, DESIGN-ENGINEERING, *FIELD TESTING,
0399 SPILL RECOVERY, SKIMMERS, PRODUCT INFORMATION, NORTH SEA, EKOFISK BLOWOUT, *FRAMO SKIMMER,
0406 SPILL RECOVERY, SPILL CLEANUP, PATENT, OIL-WATER SEPARATION, OIL SLICKS,
0407 SPILL RECOVERY, SEAWATER, PATENT, WASTEWATERS, *POWDERED PLASTICS, *FOAM,
0409 SPILL RECOVERY, SKIMMERS, PRODUCT INFORMATION, ALASKA/GULF OF, *CLEAN SWEEP SKIMMER,
0410 SPILL RECOVERY, SKIMMERS, PRODUCT INFORMATION, PACIFIC OCEAN, *CLEAN SWEEP SKIMMER,
0418 SPILL RECOVERY, DISPERSIONS, SURFACTANTS, TOXICITY,
0419 SPILL RECOVERY, SPILL CLEANUP, SKIMMERS, HARBORS, EPA, BOOMS, *TESTS,
R027 SPILL RECOVERY, SKIMMERS, EPA, *TESTING, *OHMSETT,
R030 SPILL RECOVERY, POLLUTION PREVENTION, OCEANS, FRESHWATER, *AMINE CARBAMATE GELATION TECHNIQUES,
0465 SPREADING, REFINERIES, MICHIGAN, GREAT LAKES, DISPOSAL , DISPERSIONS, COASTS, WASTEWATERS,
0589 SPREADING, OIL SPILLS, MOVEMENT, ICE, FATE, BEHAVIOR, MASSACHUSSETTS, *BUZZARDS BAY,
0694 SPREADING, SPILL CLEANUP, OIL-WATER SEPARATION, EQUIPMENT, DISPERSANTS, BIBLIOGRAPHIES,
0640 STATISTICAL ANALYSIS, CHESAPEAKE BAY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, *TAXONOMY, *ECOLOGY,
0653 STATISTICAL ANALYSIS, OIL SPILLS, GEORGES BANK, BEACHES, ATLANTIC COAST, USGS,
0709 STATISTICAL ANALYSIS, RESOURCE MANAGEMENT, POLLUTION PREVENTION, PHYSICAL EFFECTS, MODELS, COASTS, *POLLUTION SUSCEPTIBILITY,
0316 STATISTICS, NOAA, MODELS, INFORMATION SYSTEMS, GUIDELINES, ENVIRONMENTAL EFFECTS,
0317 STATISTICS, OIL SPILLS, INFORMATION SYSTEMS, CANADA, *NATES,
0318 STATISTICS, SPILL CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, *COMPUTER DIRECTORY,
0319 STATISTICS, SAMPLING, POLAND, COASTS, BIRDS, BALTIC SEA,
0324 STATISTICS, MONITORING, INFORMATION SYSTEMS, *COMPUTER DIRECTORY,
0434 STATISTICS, PORTS, POLLUTION CONTROL, OIL TRANSFER, HARBORS, ENVIRONMENTAL EFFECTS, UK, *MILFORD HAVEN,
R038 STATISTICS, PERSONNEL TRAINING, INFORMATION SYSTEMS, TANKERS, *TANKER CASUALTIES, *COMPUTER SERVICES,
0392 STORAGE, SPILL RECOVERY, PRODUCT INFORMATION, DESIGN-ENGINEERING, *DRACONE BARGE,
0433 STORAGE, POLLUTION PREVENTION, JAPAN, OIL TANKS, *AIR CUSHION MOVEMENT ,
0436 STORAGE, MEXICO/GULF OF, LOUISIANA, DISPOSAL , *SALT DOMES, *BRINE DISCHARGE,
0437 STORAGE, SOCIO-ECONOMIC EFFECTS, EIS, WATER QUALITY, *STRATEGIC PETROLEUM RESERVE,
0438 STORAGE, EIS, *STRATEGIC PETROLEUM RESERVE,
0439 STORAGE, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, COST ANLYSIS, *STRATEGIC PETROLEUM RESERVE,
0440 STORAGE, REFINING, PETROLEUM PRODUCTS, OIL SPILLS, FUELS , FUEL OIL, OIL TRANSPORT,
0443 STORAGE, OIL TANKS, CONTAMINATION, *CORROSION,
R033 STREAMS, PIPELINES, MONITORING, FISH, BIOLOGICAL EFFECTS, ALASKA, WATER QUALITY, *TAPS,
0608 SUBARCTIC REGIONS, SOURCES, PETROLEUM PRODUCTS, OCEANS, MARINE ORGANISMS, HYDROCARBONS , FATE, ARCTIC,
R054 SUBARCTIC REGIONS, MICROORGANISMS, METABOLISM, DECOMPOSITION, CRUDE OIL, BIODEGRADATION, BASELINE STUDIES, ARCTIC,
0543 SUBLETHAL EFFECTS, MORTALITY, MARINE ORGANISMS, EMULSIFIERS, CRUSTACEANS, *COPEPODS,
0547 SUBLETHAL EFFECTS, CRUDE OIL, ALGAE, WSF, *FUCUS SERRATUS, *ZYGOTE DEVELOPMENT,
0548 SUBLETHAL EFFECTS, FISH, DISPERSANTS, BIOLOGICAL EFFECTS, SURFACTANTS,
0553 SUBLETHAL EFFECTS, METABOLISM, MARINE ORGANISMS, TOXICITY, *EGG AND LARVAL STAGES,
0559 SUBLETHAL EFFECTS, MOLLUSKS, CRUDE OIL, BEHAVIOR, BALTIC SEA,
0565 SUBLETHAL EFFECTS, CRUDE OIL, BIRDS, *HERRING GULL,
0577 SUBLETHAL EFFECTS, POLYCHAETES, FUEL OIL, CRUDE OIL, WSF, TOXICITY, *NEANTHES ARENACEODENTATA,
0579 SUBLETHAL EFFECTS, CRUDE OIL, CHRONIC EFFECTS, BIRDS, *INGESTION, *MALLARD DUCKS,
0593 SUBLETHAL EFFECTS, SOURCES, OFFSHORE PRODUCTION, MARINE ORGANISMS, HYDROCARBONS , FATE, ENVIRONMENTAL EFFECTS, *SYMPOSIUM,

0599 SUBLETHAL EFFECTS, RELEASE, PETROLEUM PRODUCTS, MORTALITY, CARCINOGENS, BIODEGRADATION, UPTAKE,
R040 SUBLETHAL EFFECTS, MARINE ORGANISMS, HYDROCARBONS , FUEL OIL, CHRONIC EFFECTS, BEHAVIOR, *CHEMORECEPTION,
R045 SUBLETHAL EFFECTS, PETROLEUM PRODUCTS, MORTALITY, MARINE ORGANISMS, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY,
0356 SURFACTANTS, SEAWATER, HYDROCARBONS , DETECTION, CHEMICAL ANALYSIS, ANALYTICAL TECHNIQUES,
0418 SURFACTANTS, SPILL RECOVERY, DISPERSIONS, TOXICITY,
0452 SURFACTANTS, PATENT, EMULSIONS, WASTEWATER TREATMENT,
0471 SURFACTANTS, PATENT, FILTRATION , WASTEWATER TREATMENT,
0493 SURFACTANTS, OIL-WATER SEPARATION, FLOTATION, EMULSIONS,
0534 SURFACTANTS, PETROLEUM PRODUCTS, MICROORGANISMS, BIOLOGICAL EFFECTS,
0548 SURFACTANTS, SUBLETHAL EFFECTS, FISH, DISPERSANTS, BIOLOGICAL EFFECTS,
0442 SURVEILLANCE, SAFETY, POLLUTION PREVENTION, DESIGN-ENGINEERING, TANKERS, US,
0383 TANKERS, SPILL CONTAINMENT, PRODUCT INFORMATION, POLLUTION CONTROL, EQUIPMENT, BOOMS, *LUCAN BOOM,
0432 TANKERS, SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, USCG, *DOUBLE BOTTOMS, *EMERGENCY STEERING,
0435 TANKERS, PIPELINES, OIL TRANSPORT, EPA, ENVIRONMENTAL DETERIORATION, ALASKA, WATER QUALITY, US,
0441 TANKERS, REGULATIONS, IMCO, DESIGN-ENGINEERING, BALLAST , *COMPUTER METHODS,
0442 TANKERS, SURVEILLANCE, SAFETY, POLLUTION PREVENTION, DESIGN-ENGINEERING, US,
0448 TANKERS, BILGES, BALLAST , WASTEWATER TREATMENT, *SHORE FACILITIES,
0470 TANKERS, SLUDGE , POLLUTION PREVENTION, OIL DISCHARGES, BALLAST , *CRUDE OIL WASHING,
0505 TANKERS, SHIPS, REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING,
0508 TANKERS, SAFETY, REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, OIL TRANSFER, OIL DISCHARGES,
0511 TANKERS, POLLUTION PREVENTION, DESIGN-ENGINEERING, *ANTI-POLLUTION VALVE,
0513 TANKERS, POLLUTION PREVENTION, DESIGN-ENGINEERING,
0514 TANKERS, SAFETY, PORTS, POLLUTION CONTROL, PERSONNEL TRAINING, MONITORING, *EXXON,
0517 TANKERS, SAFETY, PRODUCT INFORMATION, *GEC MECHANICS HANDLING LTD, *COUPLING,
0518 TANKERS, POLLUTION PREVENTION, OIL TANKS, CRUDE OIL, BALLAST , *LOAD-ON-TOP, *CRUDE OIL WASHING,
0521 TANKERS, SEGREGATED BALLAST, POLLUTION PREVENTION, INTERNATIONAL AGREEMENTS, *CRUDE OIL WASHING,
0522 TANKERS, SOURCES, POLLUTION CONTROL, MEDITERRANEAN SEA, HYDROCARBONS , CHRONIC EFFECTS, TAR,
0523 TANKERS, REGULATIONS, POLLUTION PREVENTION, PERSONNEL TRAINING, OIL SPILLS, USCG, STANDARDS, *NAVIGATION AIDS,
0542 TANKERS, MICROORGANISMS, HYDROCARBONS , CRUDE OIL, CHEMICAL ANALYSIS, BIODEGRADATION,
0604 TANKERS, SOURCES, OIL INDUSTRY, NATURAL SEEPAGE, INLAND, ENVIRONMENTAL EFFECTS, WATER QUALITY,
0623 TANKERS, REFINERIES, POLLUTION CONTROL, PLATFORMS, PETROCHEMICALS, OIL SPILLS, MANUALS, ENVIRONMENTAL PROTECTION, EIS,
0634 TANKERS, OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ATLANTIC OCEAN,
0637 TANKERS, SOURCES, PORTS, OIL TERMINALS, OFFSHORE DRILLING, NORTH SEA, BIOLOGICAL EFFECTS, UK, *CELTIC SEA,
0674 TANKERS, SEGREGATED BALLAST, SAFETY, REGULATIONS, LEGISLATION, DESIGN-ENGINEERING, US,
0675 TANKERS, OIL TERMINALS, OIL INDUSTRY, LIABILITY, LEGISLATION, COMPENSATION, US, *OIL SPILL FUND,
0681 TANKERS, POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS,
0684 TANKERS, LIABILITY, INTERNATIONAL AGREEMENTS, COMPENSATION, ARGO MERCHANT SPILL,
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0340 TAR, SAMPLING, OCEANS, NEUSTON, INDIAN OCEAN, DISTRIBUTION, ATLANTIC OCEAN, *NEUSTONIC PERIPHYTON,
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136,294	C-0488
US Patent	
3,908,443	C-0327
4,029,569	C-0498
4,030,304	C-0385
4,031,707	C-0422
4,032,443	C-0471
4,033,137	C-0388
4,033,869	C-0414
4,051,024	C-0412
USSR Patent	
567,678	C-0481
570,558	C-0479

APPENDIX A

Periodicals Reviewed

Abstracts on Health Effects of Environmental Pollutants
Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Analytical Chemistry
Applied Ecology Abstracts
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Komission fuer Meeresforschung
Bibliography and Index of Geology
Biological Abstracts
Bioresearch Index
Bioscience
British Birds
Bulletin of Environmental Contamination and Toxicology
Bulletin of Marine Science
Catalyst for Environmental Quality
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Coastal Zone Management Journal
Conservation News
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research/Oceanographic Bibliography
Ecolibrium
Ecological Abstracts
Ecological Modelling
The Ecologist
Ecology Law Quarterly
Effluents & Water Treatment Journal
Energy Information Abstracts
Energy Review
The Engineering Index Monthly
Environment
Environment Abstracts
Environmental Action

Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control
Environmental Periodicals Bibliography
Environmental Pollution
Environmental Research
Environmental Science & Technology
Environmental Technology and Economics
EPA Reports Bibliography Quarterly
ERDA Energy Research Abstracts
Estuarine and Coastal Marine Science
Fuel Abstracts and Current Titles
Government Reports Announcements
Groundwater
Hydrocarbon Processing
India Journal of Environmental Health
Industrial Wastes Information Bulletin
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Journal of Environmental Studies
International Petroleum Abstracts
Iranian Journal of Science and Technology
The Journal of Applied Ecology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health, Part A
Journal of Environmental Sciences
Journal of the Institute of Water Pollution Control
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Geology
Marine Geotechnology
Marine Policy
Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology
Marine Technology Society, Journal
Martime Research Information Service Abstracts
Microbial Ecology
National Fisherman
National Research Council, News Report
National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of
  Scientific Fisheries

Ocean Engineering
Ocean Industry
Ocean Management
Oceanic Abstracts
Oceanus
Offshore
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print
Progress in Water Technology
Rapports et Proces Verbaux
Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
The Sciences
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Scientific Meetings
Sea Frontiers
Sea Secrets
Sea Technology
Selected Water Resources Abstracts
Summaries of Foreign Government Environmental Reports
Technical Book Review
Toxicology
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Water, Air, and Soil Pollution
Water & Pollution Control
Water & Wastes Engineering
Water Pollution Control Federation, Journal
Water Research
Western Fisheries

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Aug 76-Oct 76	Feb 1977	EPA 600/2-77-037	PB 267-266	11.75
Nov 76-Jan 77	Apr 1977	EPA 600/2-77-075	PB 268-248	11.75
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